Installation manual

LVRSys™ - 3-phase systems

Low Voltage Regulation System™

Outdoor installation Al

Outdoor installation GRP

Pole mount

Indoor installation

Systems of the series: 180.1000.2xxx

Delivered from III/2019

Contents

1. User guidance

The installation manual contains all the important information for installation, commissioning and operation.

Read the installation manual completely and do not use the product until you have understood the installation manual.

1.1 Target group

This installation manual is intended for trained specialist personnel as well as trained and tested operating personnel.

The content of this installation manual must be made accessible to the persons responsible for the installation and operation of the system.

1.2 Warnings

Structure of the warnings

Warnings are structured as follows:

⚠ **SIGNAL WORD!**	**Type and source of danger!** Consequences of non-compliance. Measures to avoid the danger.

Gradation of the warnings

Warnings differ according to the type of hazard as follows:

⚠ **DANGER!**	Warns of an imminent danger leading to death or serious injury if not avoided.

⚠ **WARNING!**	Warns of potentially hazardous situation leading to death or serious injury if not avoided.

⚠ **CAUTION!**	Warns of a potentially hazardous situation leading to moderate or minor injury if not avoided.

ADVICE!	Warns of potentially hazardous situation that, if not avoided, may result in damage to property or the environment.

1.3 Tips

Tips for proper use of the device and recommendations.

1.4 Other symbols

Instructions

Structure of the instructions:

➲ Instructions for an action.

↳ Result of action if necessary.

Lists

Structure of unnumbered lists:

- List level 1
  - List level 2

Structure of numbered lists:

1) List level 1
2) List level 1
   1. List level 2
   2. List level 2

1.5 Other applicable documents

For safe and correct use of the system, also observe the additional documents supplied as well as relevant standards and applicable local regulations.

1.6 Storage

Keep the installation manual, including all applicable documents, in close proximity to the LVRSys system.

2. Scope of delivery/options

The LVRSys systems are built up as a modular system. The main components & documents are:

- LVRSys™ control unit (for installation in external control cabinets)
- Transformer block
- Control cabinet for outdoor or indoor installation or pole mount
- Base for outdoor installation
- Operating instructions LVRSys™
- Installation manual LVRSys™
- Circuit diagram of the control cabinet LVRSys™
- Test certificate LVRSys™.

3. Packaging

3.1 Control cabinet

The switch cabinet are packed in foil, cardboard or wood (selected order feature), standing on pallet.

Wood packaging

Figure 3-1 Switch cabinet packed in wood (example)

For special regulations (e.g. export) the packaging may differ.

Figure 3-2 Packaging & shock sticker

To protect the system, the packaging consists of particle board pieces.

➲ Before opening the crate, check the shock sticker

ADVICE!	**If the sticker is *RED*:** ➲ Do not remove packaging. ➲ Contact A. Eberle GmbH & Co. KG for further information.

3.2 Transformer block

- Outdoor installation

The transformer block is packed in foil, cardboard or wood (selected order feature), lying on pallet.

3.3 Concrete/GRP base

- Outdoor installation

The base is packed in foil (concrete base), cardboard (GRP-base) or wood (selected order feature), lying on pallet.

4. Transport

4.1 Transport with pallet

4.1.1 Switch cabinet transport on pallet

With the exception of systems for pole mounting, all switch cabinets must be transported vertically. Pole mounting systems can also be transported horizontally.

⚠ CAUTION!	**Avoid damage to the switch cabinet due to incorrect handling during transport!** Only Transport the switch cabinet upright. Ensure that the switch cabinet cannot tip over while in transit. Fasten mounting devices on the board wall.

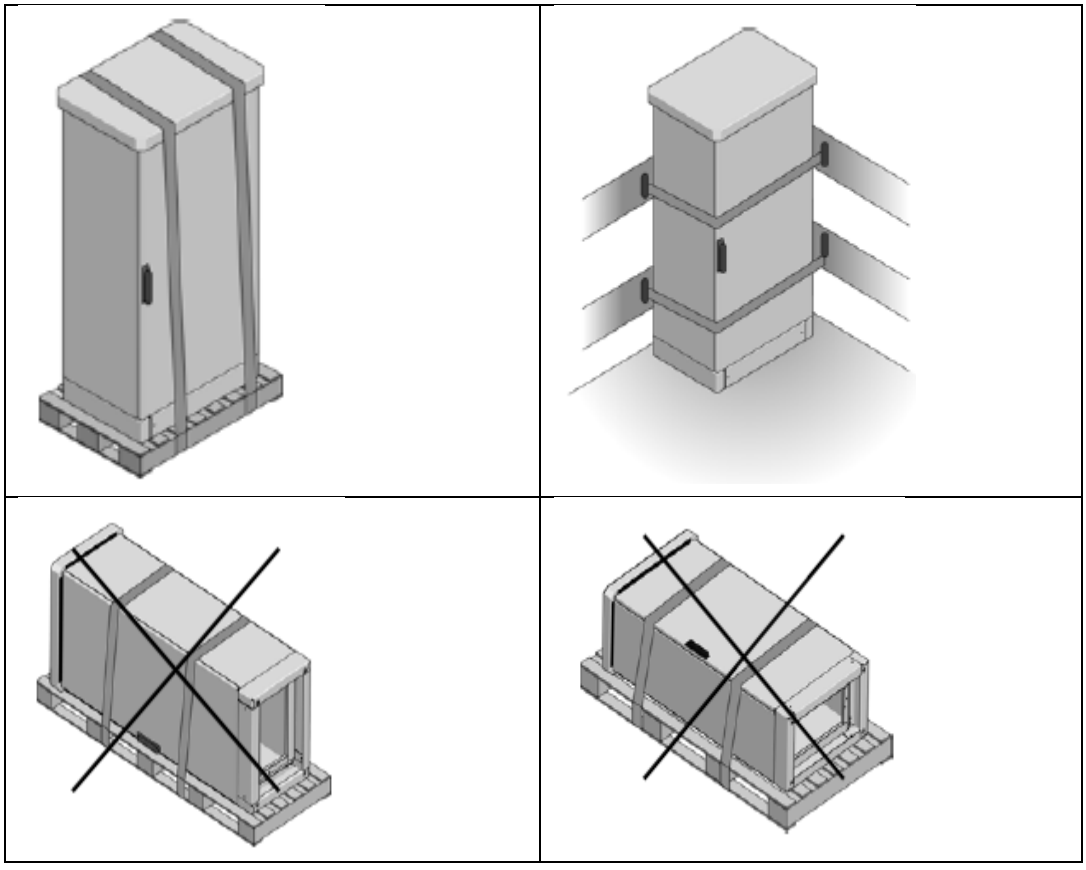


Figure 4-1 Cabinet transport on truck

4.1.2 Transformer transport with pallet (only outdoor-systems)

⚠ CAUTION!	**Avoid damage to the transformer block due to incorrect handling during transport!**
	➲ Transport transformer block in horizontal position only.
	➲ Ensure the holding devices are fastened to the tailboard.

4.1.3 Base transport with pallet

No special transport sensitivities.

4.2 Lifting devices

⚠ DANGER!	**Danger to life if the switch cabinet is dropped during lifting!**
	➲ Ensure that no body is standing under or nearby to the suspended load.

⚠ CAUTION!	**Damage to the system if the control cabinet is dropped!**
	➲ Always secure the LVRSys™ switch cabinet by the lifting lugs.
	➲ Only lift the cabinet vertically (deviation up to a maximum of 60°) to the lifting lugs.
	➲ Ensure the lift upward of the LVRSys™ switch cabinet is done smoothly without any jerks.

4.2.1 Use of a crane and the lifting lugs of the Aluminum switch cabinet

Transport lugs are located under the weather protection roof.

Removing the weather protection roof:

- ➲ Loosen the screws at the front (1).
- ➲ Lift the hood at the front (2).
- ➲ Push the hood to the back (3).
- ➲ Lift the hood upward (4).

Installing the weather protection roof:

- ➲ Lower the hood from above (5).
- ➲ Push the hood to the front (6).
- ➲ Fasten the screws at the front (7).

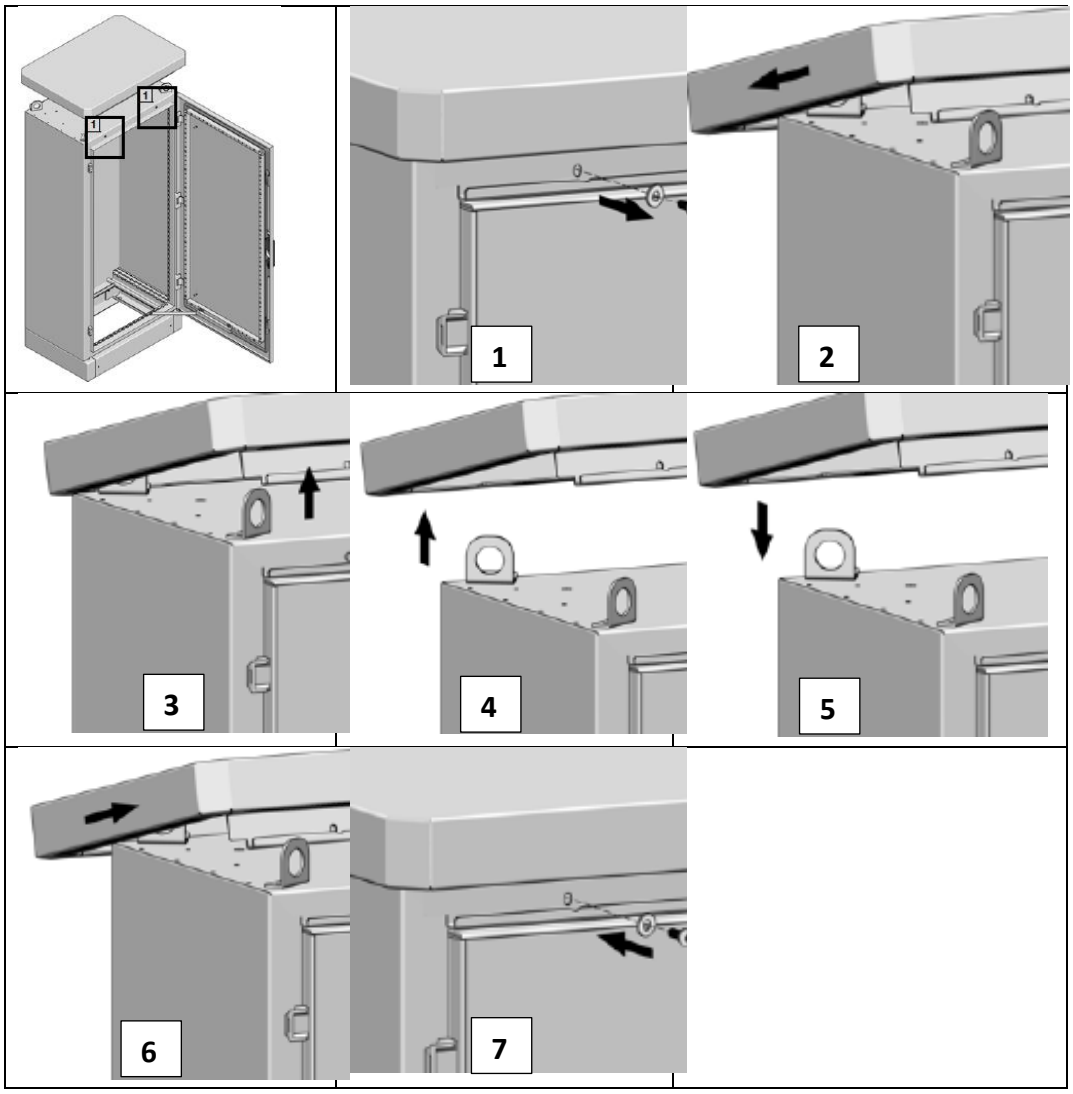


Figure 4-2 Installing and removing the weather protection roof

The screws can be loosened and fastened with a TX 25 screwdriver. The tightening torque may not exceed 6 Nm.

➲ Use all four transport lugs.

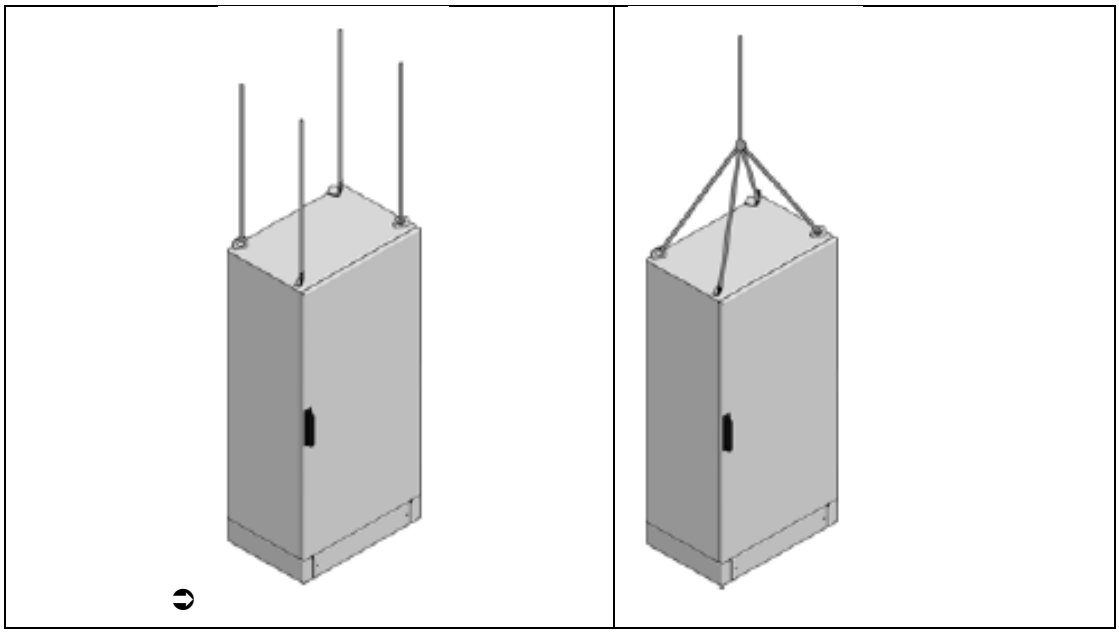


Figure 4-3 Transport lugs

4.2.2 Switch cabinet GRP

⚠ **CAUTION!**	**Damage to the switch cabinet can occur through incorrect handling during transit!** ➲ Only transport the switch cabinet in an upright position. ➲ Ensure that the switch cabinet cannot tip over. ➲ Ensure fastening of holding devices to the tailboard.

➲ Use mobile crane lugs

➲ Then seal the switch cabinet with blind plugs

Figure 4-4 mobile crane lugs

4.2.3 Installing the Switch cabinet indoors using a crane and the lifting lugs

⚠ **DANGER!**	**Danger to life if the switch cabinet is dropped!** ➲ Ensure that nobody is standing nearby or under the suspended load.

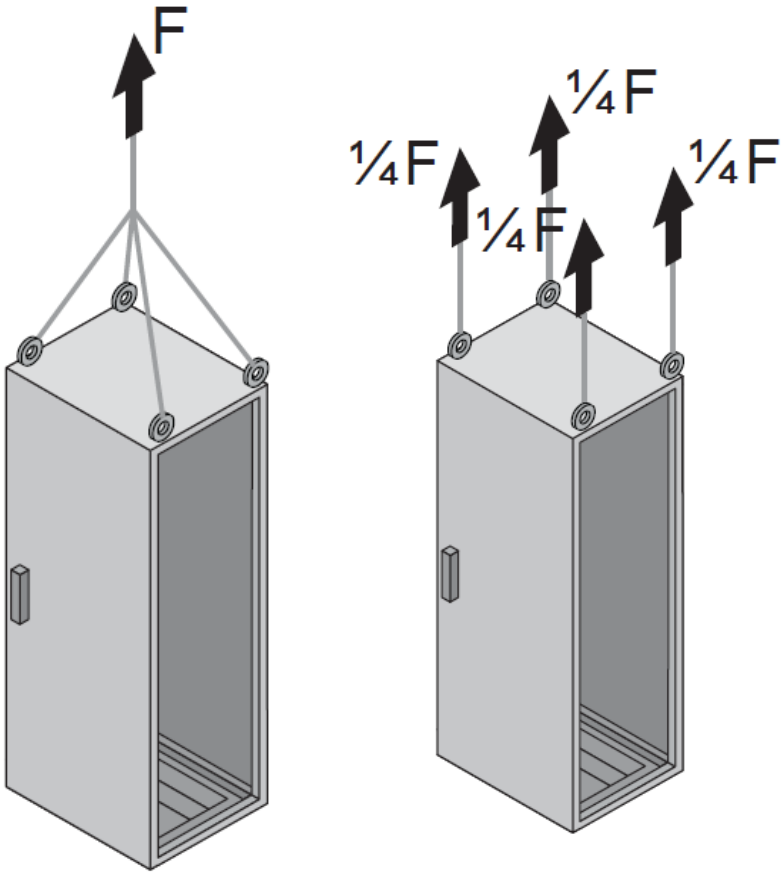


Figure 4-5 Lifting eyes distribute the weight being lifted

⚠ **CAUTION!**	**Damage to the system will occur if the switch cabinet is dropped !** ➲ Always secure the LVRSys™ switch cabinet with all lifting lugs. ➲ Only lift the cabinet up vertically (deviation up to a maximum of 60°) to the lifting lugs. ➲ Lift the LVRSys™ switch cabinet up smoothly avoiding any jerks. ➲ Systems with more than 800 kg can only be lifted vertically – straight up!

⚠ **CAUTION!**	**Damage to the system will occur if the switch cabinet is dropped!** ➲ Always move the LVRSys™ switch cabinet smoothly & evenly.

4.2.4 Pole Mount cabinet with crane lugs

Two mobile crane lugs are installed on the upper edge of the control cabinet. These are intended to lift the system.

Abbildung 4-6 mobile crane lugs

4.2.5 Lifting the Transformer with a crane using the lifting lugs

Systems with a preliminary stage and two transformer blocks must be lifted into the ground base.

⚠ DANGER!	**Risk of fatal injury if the transformer block is dropped !**
	➲ Ensure that nobody is standing nearby or under a suspended load.

⚠ CAUTION!	**Damage to the system if the transformer block is dropped!**
	➲ Always secure transformer block using all lifting lugs provided. ➲ Only lift or lower the transformer block in a vertical movement (deviation up to a maximum of 60°) to the lifting eyes. ➲ Ensure the lifting is done smoothly without any jerks to the transformer block.

Figure 4-7 Transformer block with four lifting lugs

➲ Use all four lifting lugs.

4.2.6 Concrete base

⚠ **DANGER!**	**Risk of fatal injury if the concrete base is dropped or falls over!**
	➲ Ensure that nobody is standing close-by or under a suspended load.

There are no special transport considerations.

5. Installation

⚠ **DANGER!**	**Risk of death due to electric shock!** Only install LVRSys™ in a de-energised state.

⚠ **CAUTION!**	**Destruction of components by short-circuit forces!** Use cable clamps in the in- and output of the LVRSys™.

⚠ **CAUTION!**	**Destruction of components due to overload!** Only connect the low-voltage grid in BYPASS operation. (See chapter 6.2)

Sequence for the connection to the low-voltage grid:

- ➲ Disconnect the low-voltage grid.
- ➲ Installing the system
- ➲ Check assembly
- ➲ Make sure that the system is in Bypass mode
- ➲ Connect the low-voltage grid.

NOTE! **Aluminum conductor**	For direct connection terminals With aluminum conductors, the oxide layer must be mechanically removed immediately before contacting and treated with acid- and alakali-free grease. The installation location must be kept as free as possible from moisture or aggressive atmosphere. If an aluminum conductor is used, the screw in the terminal body of the screw terminal must be tightened to the maximum permissible tightening torque of the respective terminal block. If the conductor is connected again, the conductor pretreatment must be repeated. For flat connection (also PEN/PE rail) Aluminum conductors must only be connected to the copper busbar with specially designed cable lugs (cable lugs with galvanic tinning or Al-/Cu cable lugs).

5.1 Fuse protection

For protection against short circuits and continuous overcurrents, all systems are equipped with protective devices in accordance with Table 5-1/Table 5-2. In externally fused systems, the rated current of the fuses must not exceed the rated currents of the respective systems.

➲ Only after consultation with the A. Eberle Support Team may larger fuses than specified be used.

5.1.1 Fuse protection for systems with switch-disconnector-fuses

Protective devices	*Coordinated fuse protection 400 V L-L*
NH fuse gG NH2	32 A (22 kVA system) 63 A (44 kVA system) 100 A (70 kVA system) 160 A (110 kVA system) 200 A (144 kVA system) 250 A (175 kVA system) 355 A (250 kVA system)
NH fuse gTr NH3	630 A (400 kVA system) 910 A (630 kVA system)

Table 5-1 Fuse protection of the systems at the switch-disconnector-fuse block input (400 V L-L)

Protective devices	*Coordinated fuse protection 230 V L-L*
NH fuse gG NH2	32 A (13 kVA system) 63 A (26 kVA system) 100 A (41 kVA system) 160 A (64 kVA system) 200 A (84 kVA system) 250 A (101 kVA system) 355 A (145 kVA system)
NH fuse gG NH3	2 x 500 A (400 kVA system)

Table 5-2 Fuse protection of the systems at the switch-disconnector-fuse block input (230 V L-L)

5.1.2 Fuse protection for systems with NH disconnectors

Protective devices	*Coordinated fuse protection 400 V L-L*
NH fuse gG NH2	32 A (22 kVA system) 63 A (44 kVA system) 100 A (70 kVA system) 160 A (110 kVA system) 200 A (144 kVA system) 250 A (175 kVA system) 355 A (250 kVA system)
NH fuse gTr NH3	630 A (400 kVA system) 910 A (630 kVA system)

Table 5-3 Fuse protection of the systems at the disconnector block input (400 V L-L)

Protective devices	*Coordinated fuse protection 230 V L-L*
NH fuse gG NH2	32 A (13 kVA system) 63 A (26 kVA system) 100 A (41 kVA system) 160 A (64 kVA system) 200 A (84 kVA system) 250 A (101 kVA system) 355 A (145 kVA system)
NH fuse gG NH3	2 x 500 A (400 kVA system)

Table 5-4 Fuse protection of the systems at the disconnector block input (230 V L-L)

5.1.3 Fuse protection for systems with automatic circuit breakers

Protective devices	*Coordinated fuse protection 400 V L-L*
Automatic circuit breaker C	32 A (22 kVA system) 63 A (44 kVA system) 100 A (70 kVA system)

Table 5-5 Fuse protection of the systems at the automatic circuit breaker input (400 V L-L)

Protective devices	*Coordinated fuse protection 230 V L-L*
Automatic circuit breaker C	32 A (13 kVA system) 63 A (26 kVA system) 100 A (41 kVA system)

Table 5-6 Fuse protection of the systems at the automatic circuit breaker input (230 V L-L)

5.2 Fuse protection (internal side)

System	F8 (3x)	F9 (3x)	Resistors Trafo big-X2	Resistors Trafo small-X2
32 A 6 % to 32 A 10 %	D01GG40V16 582.1203	X	MI5HT25V0,63 582.1020.00.63	MI5HT25V0,63 582.1020.00.63
63 A 6 % to 160 A 6 %	D02GG40V25 582.1205	X	MI5HT25V2 582.1020.02	MI5HT25V0,63 582.1020.00.63
160 A 8 % to 160 A 10 %	D02GG40V25 582.1205	X	MI5HT25V5 582.1020.05	MI5HT25V1 582.1020.01
200 A 6 % to 355 A 8 %	D02GG40V40 582.1207	X	MI5HT25V5 582.1020.05	MI5HT25V2 582.1020.02
355 A 10 % to 580 A 8 %	NH00GR50V80 582.1246	D02GG40V25 582.1205	MI5HT25V8 582.1020.08	MI5HT25V5 582.1020.05
580 A 10 % to 910 A 6 %	NH00GR50V100 582.1247	D02GG40V35 582.1206	MI5HT25V8 582.1020.08	MI5HT25V5 582.1020.05
910 A 8 % to 910 A 10 %	NH00GR50V125	D02GG40V50 582.1208	MI6SA12,5V25	MI5HT25V6,3 582.1020.06.30

Table 5-7 Protection of the systems internal side

Measuring voltage taps Output voltage (XF) are protected with G-fuse links super-fast FA 5x20 3.15 A (MI5FA25V3.15 / 582.1018). Measuring Voltages Input voltage (XF) are protected by G-fuse links super-fast FA 6.3x32 3.15 A (MI6FA25V3.15).

5.3 Systems outdoor installation

5.3.1 Outdoor installation requirements

⚠ **CAUTION!**	**Damage to the system due to tilting of the control cabinet!** Anchoring the earth base in the foundation Check whether stability is guaranteed

- ➲ Ensure that heat can be dissipated through adequate air circulation.
- ➲ Ensure that the door area is freely accessible.

5.3.2 Ground hole for concrete base and GRP base

Generally, the base is anchored in the ground so that tilting and sagging can not be caused.

Work to be carried out:

- ➲ Dig a 110 cm to 130 cm deep hole in the ground.
- ➲ Use ballast and gravel and concrete of adequate depth to form a solid foundation.
- ➲ Level the foundation.
- ➲ Install the base and fix it with the foundation (stability).

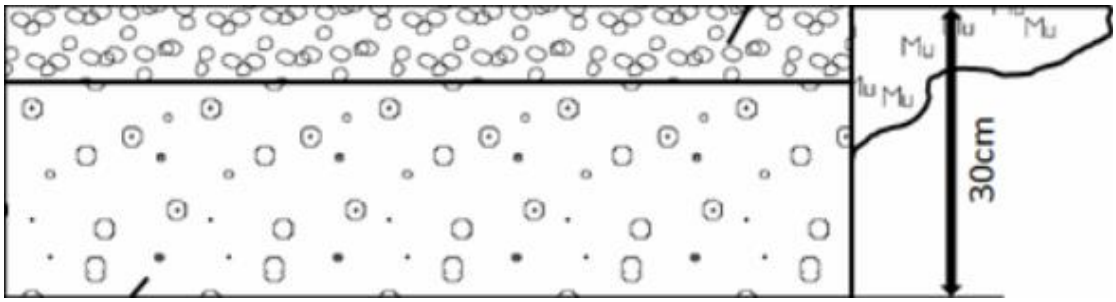


Figure 5-1 Foundation

Special requirements of the GRP-base

The connection profile can not be used due to the transformer block. The side panels must be fixed with cement or similar.

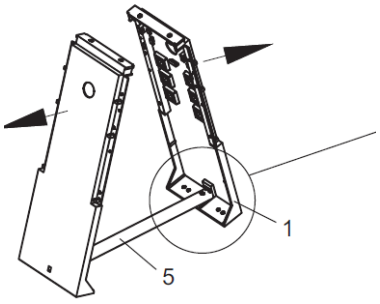


Figure 5-2 Side panels of the GRP base

5.3.3 Concrete Plinth mounting

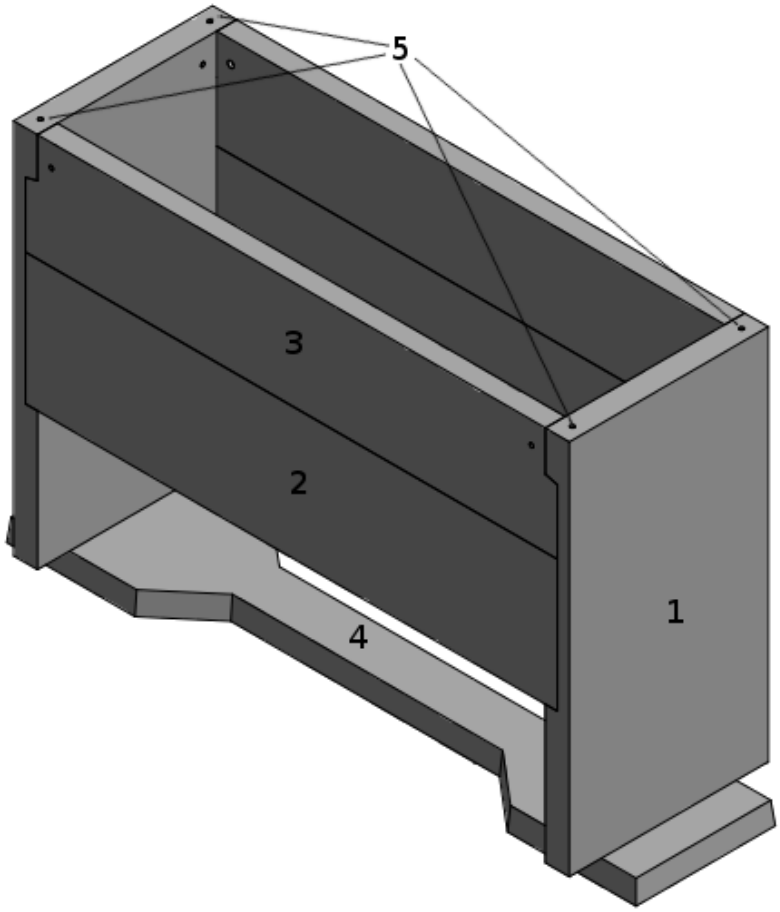


Figure 5-3 Base building

Position	Quantity	Designation
1	2x	Side panels left and right
2	2x	Front and back wall bottom (large plate)
3	2x	Front and back wall top (small plate)
4	1x	Base plate
5	1x	Mounting points for control cabinet M12
		Mounting material
		Mounting screws

Tabelle 5-8 Explanation of the numbering and delivery scope

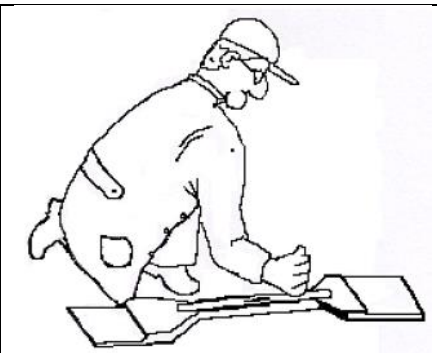
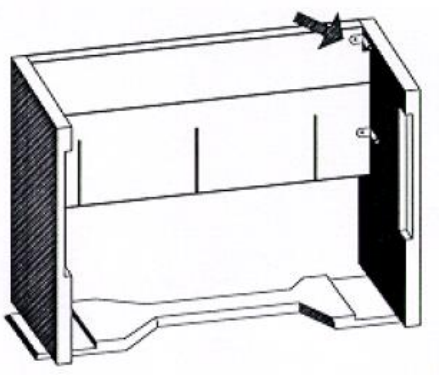
Two people are required to set up the plinth.

Required tools:

- Spirit level
- Spanners 13mm and 19mm with 25 Nm

- If the plinth is bordered with paving stones or similar, a minimum distance of 5 cm from the plinth must be maintained all around to provide an expansion joint.
- Vibrators/compactors must not come into contact with the plinth.

To ensure optimum stability for the switch cabinet, its recommended that the base and side panels are packed with earth-or a moist concrete slurry.

NB: For clarity the following illustrations show the plinth assembled on the ground. In practice assembly can actually take place in the hole in the ground. In the situation of the concrete plinth being assembled above ground then a crane will be required to lift and lower the plinth into position into the hole.	
Align base plate with recesses facing up-wards.	
Place the side panels on the base plate with the folds facing upwards.	
Fasten the rear panel: Connect the larger plate at the bottom with two screws and angles with the side panels. Connect the smaller plate at the top with two screws and brackets with the side parts.	

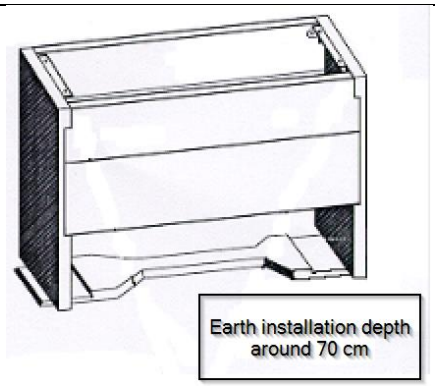
Carry out cable work. From the 2-part front wall, first connect the larger plate at the bottom with 2 screws and brackets to the side parts. Then connect the smaller plate at the top with 2 screws and angle brackets to the side panels. The installation depth of the concrete plinth down into the ground should be around 70 cm.	

Figure 5-4 Concrete plinth mounting

5.3.4 GRP base mounting

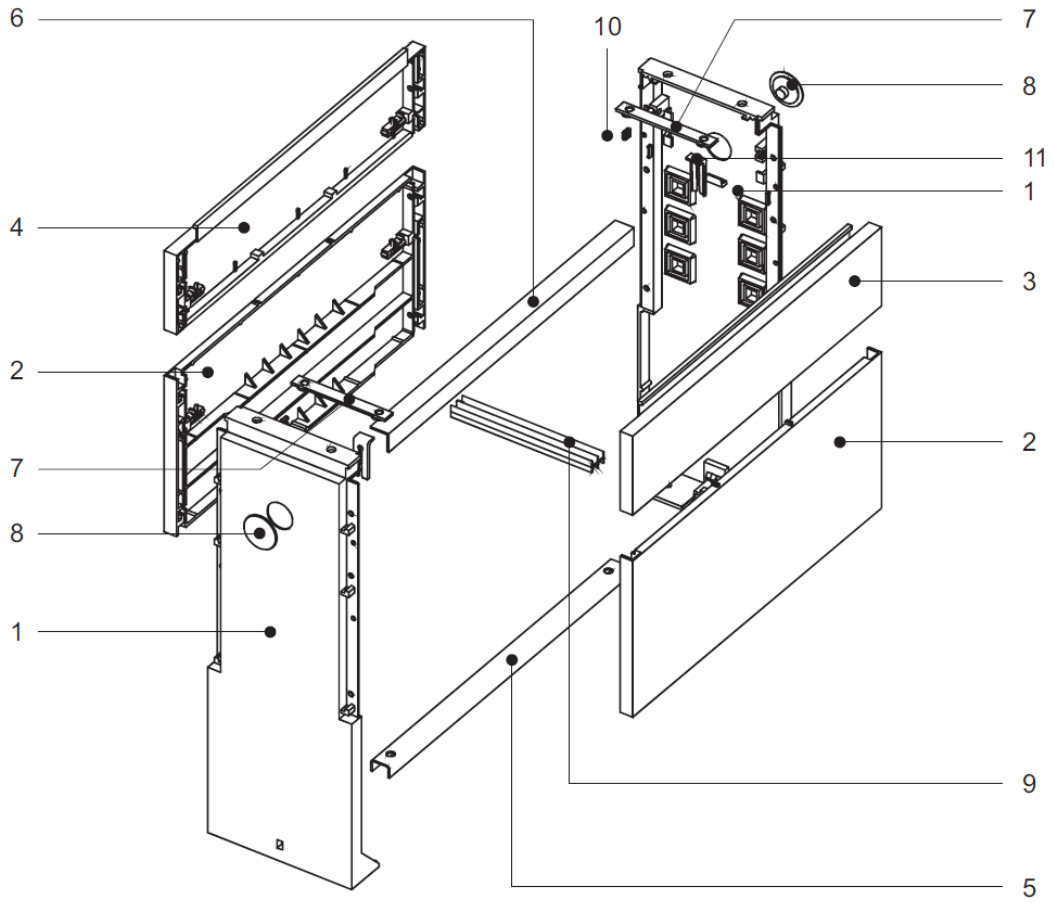
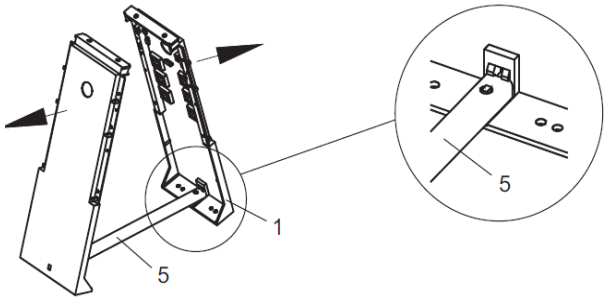
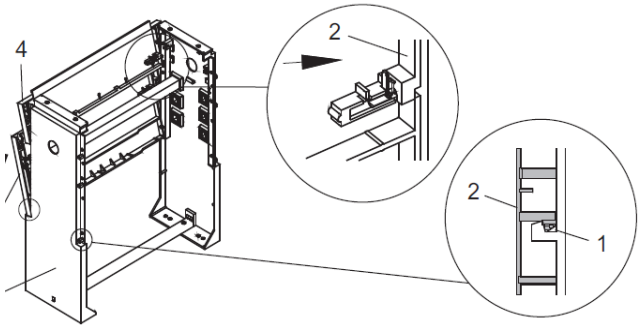
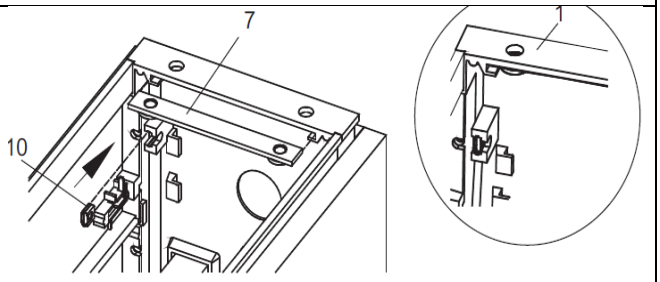
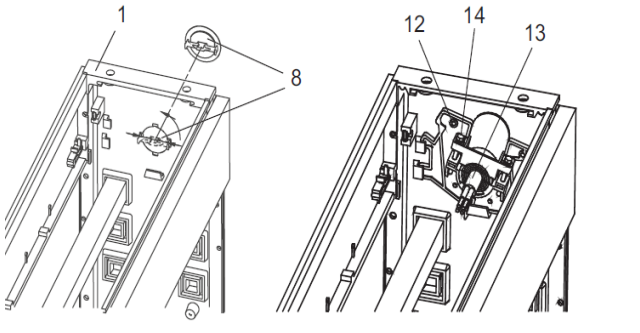


Figure 5-5 GRP base mounting

Position	Quantity	Description
1	2x	Side panel left and right
2	1x each	Front and rear panel, bottom
3	1x	Front wall top (without locking slide)
4	1x	Rear panel, top
5	1x	Longitudinal stabilization rail (no use)
6	1x	Cable fixing rail
7	2x	Mounting rail for standard cable distribution cabinet
8	2x	Blanking plugs for construction site closure
9	Gr. 1=1x; Gr.2=2x	Cross stabilization bar
10	2x	Fixing nut for PEN bus bar mounting

Table 5-9 Explanation of numbering

The longitudinal stabilization rail (5) is inserted obliquely into the provided holders in the side walls (1). Press both side walls slightly inwards until the stabilization rail engages, then place the side walls outwards. The base already has a good stability for further installation. The longitudinal stabilization rail is only for the construction of the bas and must be removed before inserting the transformer-block.	
Insert the front and rear panels (2) at an angle into the side panels (1), fold them in and press them down. Proceed according to the same principle for the top rear panel (4) and the top front panel. Then press two locking slides outwards into each of the side walls. Note: the top front wall has no locking slides!	
Insert the fixing rail (7) to secure the cabinet in the two holders on the side walls (1). If necessary, insert the supplied fastening nuts (10) for PEN bus bar fastening.	
Squeeze the blind plug for construction site closure (8) together, turn it 90°C and remove it from the side panel (1). Push in the s6train relief (12) from above until it engages. Insert the cable (13) and tighten the two clamping screws (14).	

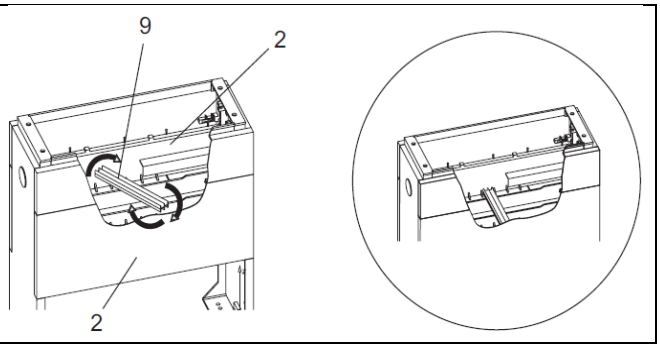
Finally, the cross stabilization slide (9) is inserted into the holders provided in the front & rear wall at the bottom (2). Two cross stabilization rails are included with every size 2 base.	

Figure 5-6 GRP base mounting

➲ Installation of the C profile rails to strengthen the side panels (both side elements).

Figure 5-7 installation of the C-profile rails

➲ Installation of the C profile rail to fix the cable clamp on the right side (below the NH switch disconnectors)

Figure 5-8 Installation of the C-profile rail (for the cable clamps)

5.3.5 Inserting the transformer block & if applicable, the preliminary stage

- Install the transformer block on the left side (viewed from the front) into the base.
- The Transformer block with load bar (thick cables) is located on the left and the connection cable control electronics (thin cable with plug) is on the right.

Optional Preliminary stage -Transformer block

- The Transformer block preliminary stage if applicable is recessed into the socket to the right of the transformer block (optional).
- On the Transformer-block preliminary stage the connection cable LIN is on the left and the connection cable LOUT is on the right.
- Position the transformer block so that it is not touching any of the walls of the plinth or switch cabinet.

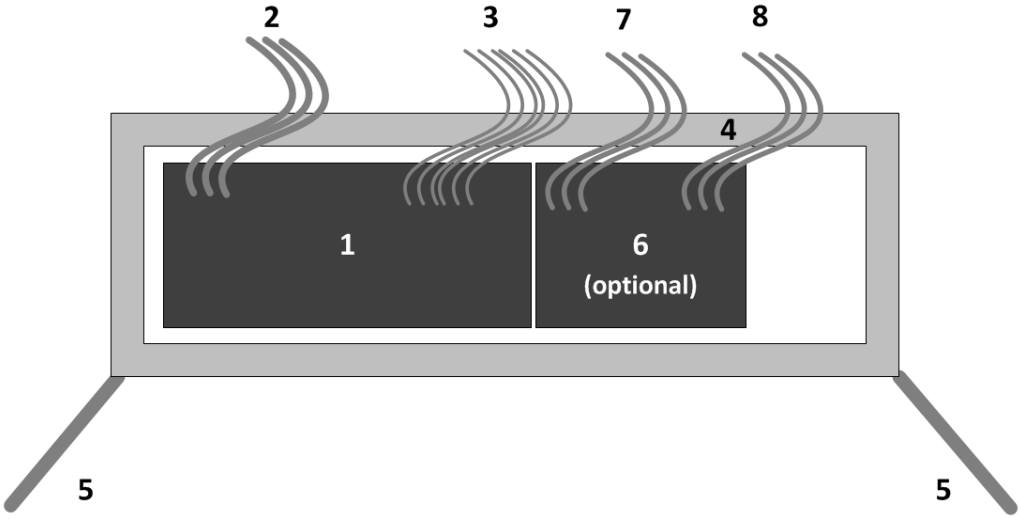


Figure 5-9 : Top view of concrete base, transformer block & the (optional) preliminary stage

1	Transformer block
2	Connection cable load bar (thick cables)
3	Connection cable control electronics (thin cable with plugs)
4	Concrete base
5	Switch cabinet doors open
6	Transformer block preliminary stage (optional)
7	Connection cable primary lines preliminary stage LIN (optional)
8	Connection cable secondary lines preliminary stage LOUT (optional)

Table 5-10 Explanation of numbering

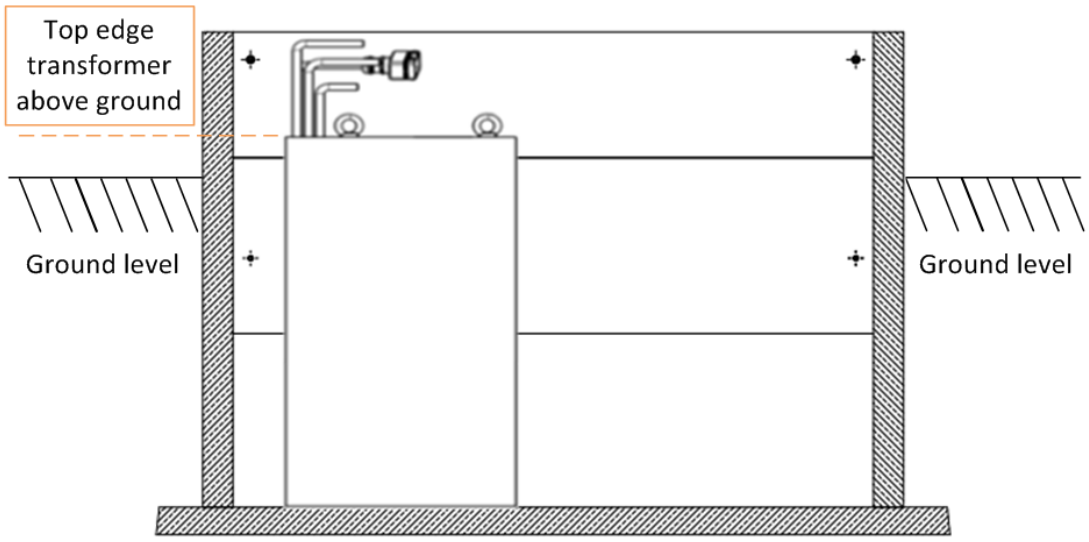


Figure 5-10 Installation of the transformer block in relation to the ground level.

5.3.6 Filling layer around the plinth

The base may be filled with earth. Base fillers may only be used above the transformer block.

5.3.7 Mounting the switch cabinets for outdoor installation onto a base

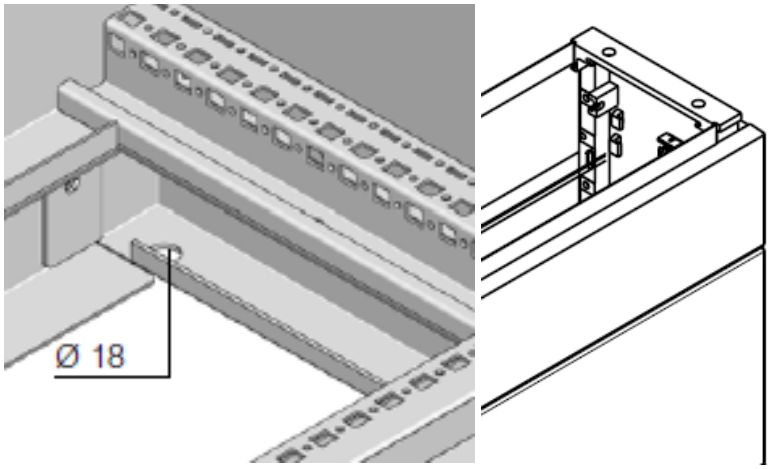


Figure 5-11 Mounting ducts; left: aluminium cabinet; right: GRP-cabinet

- Connect the switch cabinet through four mounting ducts with the base.
- Only use the provided screws M 12 x 25 mm.

5.3.8 Locking the switch cabinets - outdoor installations

5.3.8.1 Installing and removing the locking cylinder:

- Open the lock cover to the right (1).
- Insert the key into the locking cylinder and unlock it to the right (2).
- Unscrew the fastening screw (M5) from the locking cylinder (3).
- Pull out the locking cylinder towards the switch cabinet (4).
- Push in the new locking cylinder (5).
- Screw the fastening screw (M5) into the locking cylinder (6).
- Lock the key in the locking cylinder and turn it to the left (7).
- Close the lock cover to the left (8).

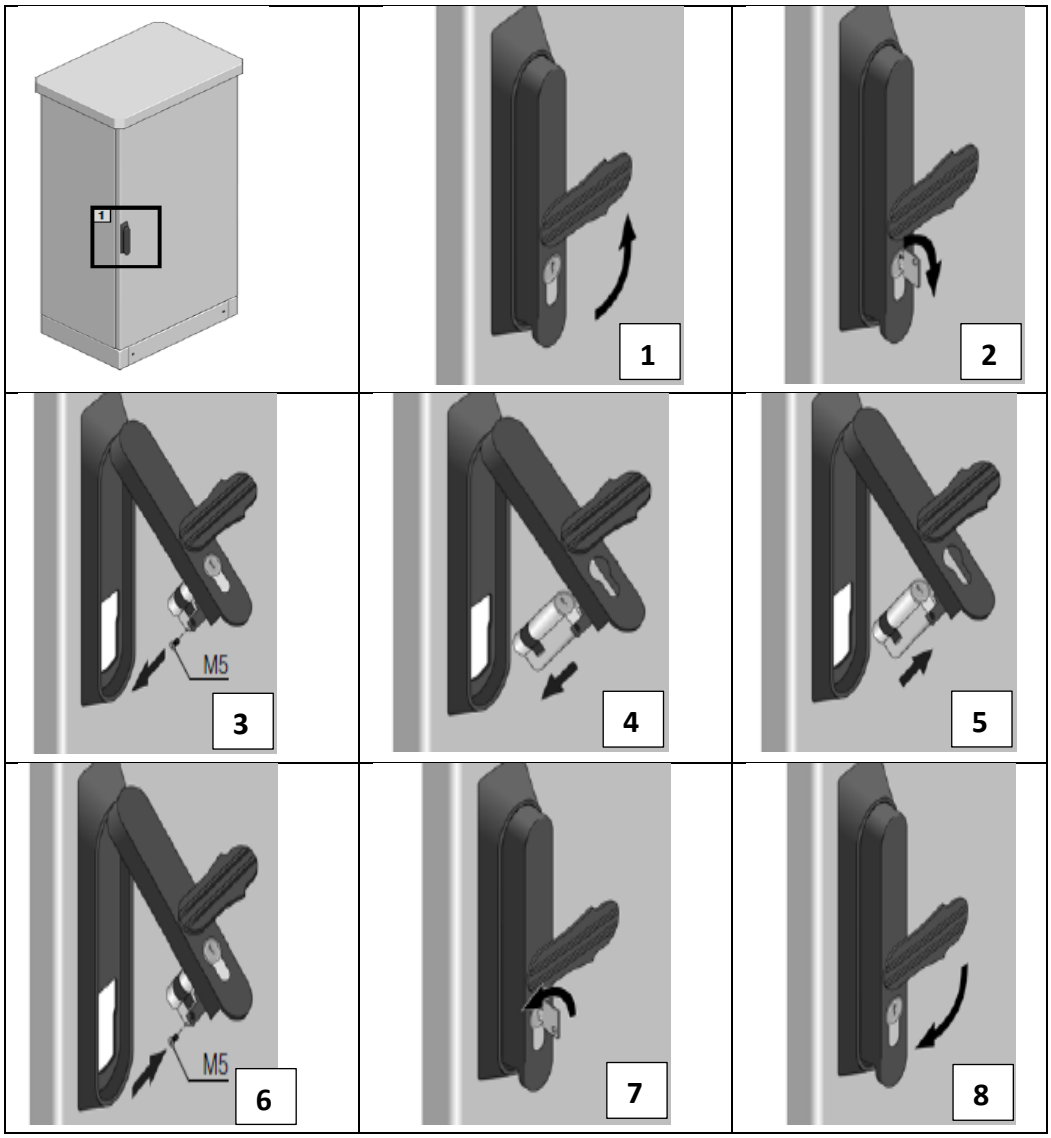


Figure 5-12 Installing and removing the locking cylinder

5.3.8.2 Locking systems with padlock and push button:

Figure 5-13 Assembly and disassembly locking cylinder

Padlocks up to 7 mm shackle thickness can be used with the padlock system to accomodate a padlock. To open the switch cabinet, remove the padlock and press the push button on the top of the handle.

5.3.9 Connection of the transformer block to the control unit

For outdoor installations, the transformer-block and the LVRSys™ switch cabinet consisting of the control unit and the bypass system, must always remain connected. In complete indoor installation systems, the connections are completed during manufacture.

5.3.9.1 Transformer contact plug (systems 32 A 6 % to 160 A 10 %)

- Place the coded plug at the bottom of the case.
- Lock the plug. Secure the cables with cable clamps.

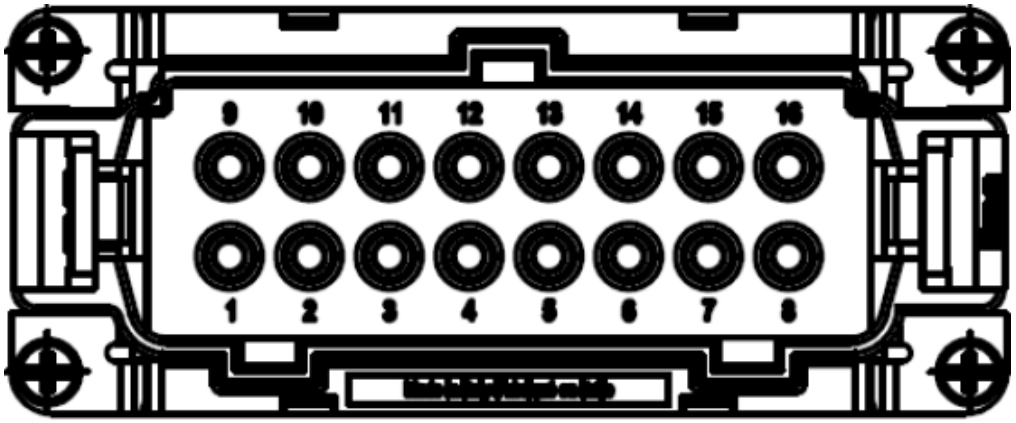


Figure 5-14 Transformer contact plug 32 A 6% to 160 A 10%

5.3.9.2 Transformer contact plug (systems 200 A 6 % to 355 A 8 %)

- Place the coded plug at the bottom of the case.
- Lock the plug. Secure the cables with cable clamps.

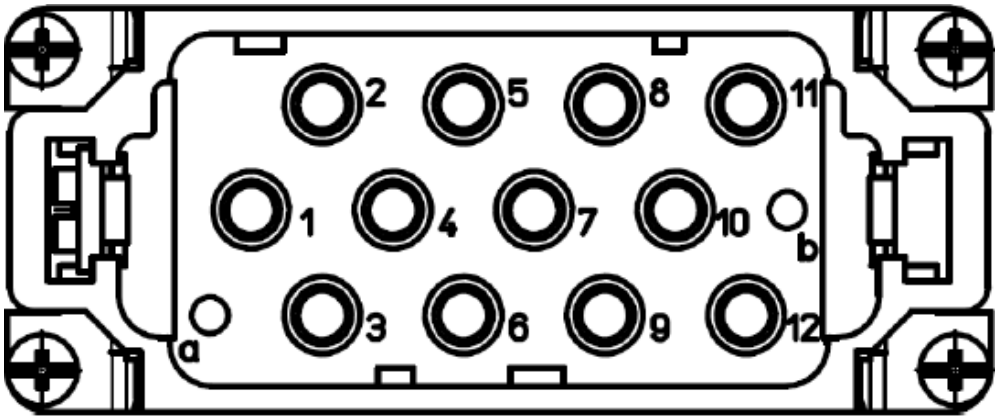


Figure 5-15 Transformer contact plug 200 A 6% to 355 A 8%

5.3.9.3 Transformer contact plug (systems 355 A 10 % to 580 A 10 %)

- Place the coded plug at the bottom of the case.
- Lock the plug. Fix the cables with cable clamps.

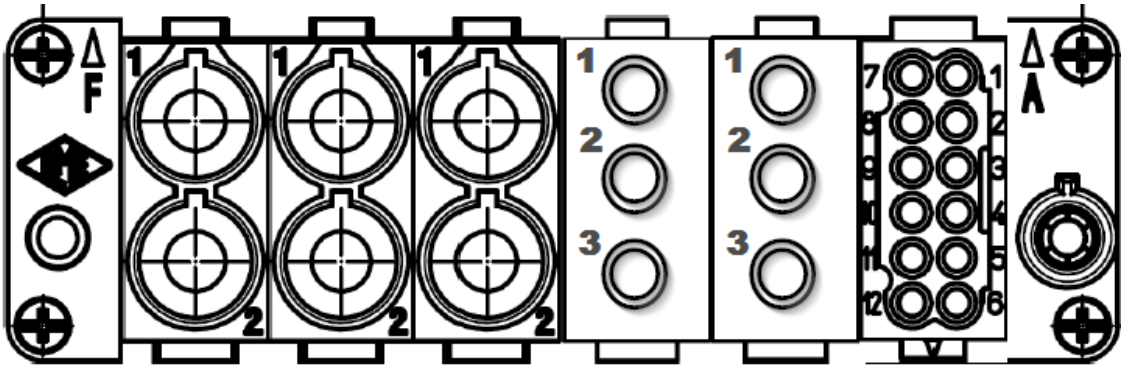


Figure 5-16 Transformer contact plug 355 A 10 % to 910 A %

5.3.9.4 Transformer contact plug (systems 910 A 6 % to 910 A 10 %)

For 910 A systems, 6 lines must be routed through cable glands. The lines must be connected in accordance with the labeling in the cabinet, and the contact plug must be inserted.

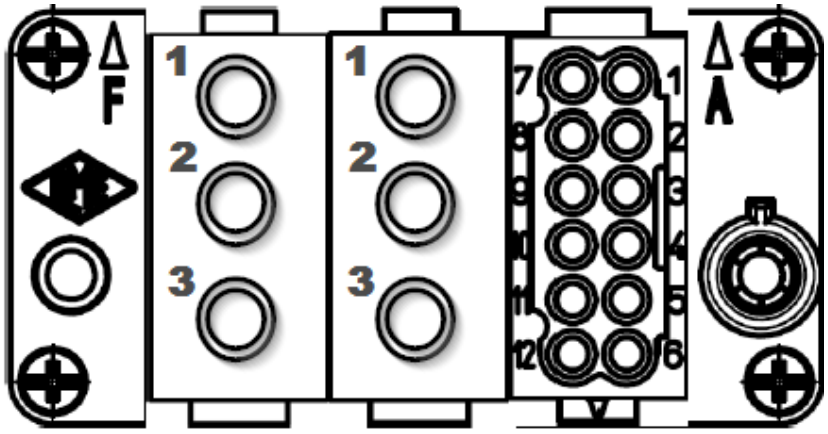


Figure 5-17 Transformer contact plug 910 A 6 % - 10%

5.3.10 Connection of the low voltage cables & grounding

The system operator must ensure that a local grounding point in accordance with DIN 18014 or DIN EN 62305-3 exists.

The arrangement of the PE(N) busbars is matched to the arrangement of the fuse-switch-disconnectors.

⚠ **CAUTION!**	**Heating of terminal points due to improper connection!**
	➲ Aluminum conductors must only be connected to copper busbar with specially designed cable lugs (cable lug with galvanic tinning or Al-/Cu cable lugs).

With sector conductors, make sure that the conductors nestle in the terminal.

Figure 5-18 Sector conductors in connection terminals

5.3.10.1 Systems with fuse-switch-disconnectors

- ➲ Connect local grounding point to *PE(N)-rail*.
- ➲ Connect PEN input (transformer grid connection) to *PE(N)-rail*.
- ➲ Connect PEN output (load grid connection) with *PE(N)-rail*.
- ➲ Connect transformer block with *PE(N)-rail*.
- ➲ Connect the connecting cables of the transformer block with fuse-switch-disconnectors
- ➲ Connect the connecting cables of the low-voltage grid with fuse-switch-disconnectors

For NH00 switch-disconnectors and current transformers observe chapter 5.3.10.4.
The operation of the terminals is described in chapter 5.3.10.3.

TN-C system

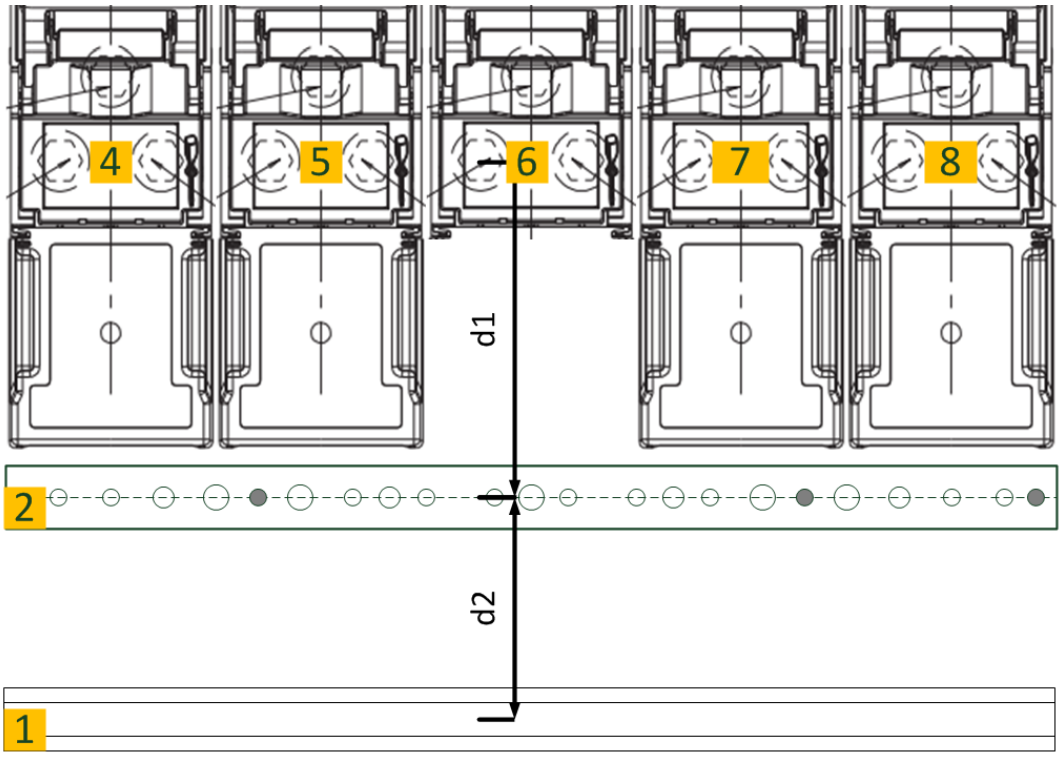


Figure 5-19 Overview of terminal points for TN-C systems and fuse-switch-disconnectors

TN-S/TT system

The N-rail is located behind the covers of the load switch rails.

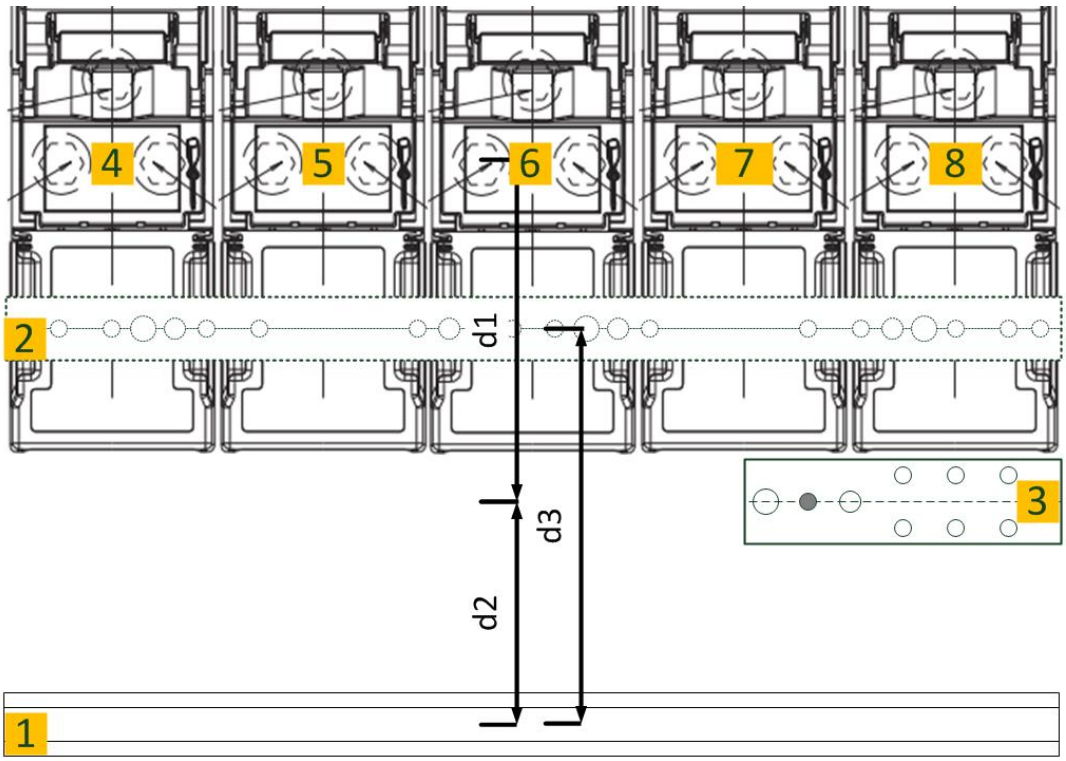


Figure 5-20 Overview of clamping points for TN-S/TT systems and fuse-switch-disconnectors

Numbering	Explanation
1	C-profile rail 30x15 for fixing the cables
2	TN-C PEN-rail 30 mm x 5 mm x 400 mm – 500 mm Free rivet nuts M8/M10/M12 TT/TN-S N-rail 30 mm x 5 mm x 400 mm – 500 mm Free rivet nuts M8/M10/M12
3	PE rail 40 mm x 5 mm x 150 mm Free rivet nuts M8/M10/M12
4 (F1)	3x connecting cable (thick cable) of the transformer block (L1IN / L2IN / L3IN)
5 (F2)	Customer connection input side (direction local grid transformer)
6 (F3)	Bypass strip (no connection required)
7 (F4)	Customer connection output side (direction load)
8 (F5)	3x connecting cable (thick cables) of the transformer block (L1OUT / L2OUT / L3OUT)
d1	Centre distance PE(N) rail to connection points fuse-disconnectors 180 mm
d2	Centre distance PE(N) rail to C-profile rail (cable catch) Aluminum housing: 215 mm GRP housing: 145 mm
d3	Centre distance N conductor terminal block to C-profile rail Aluminum housing: 290 mm GRP housing: 190 mm

Table 5-11 Explanation of the graphics

Torques of the connection points

No.	Explanation			
	$I_N \leq 160$ A		160 A $< I_N \leq 355$ A	
	Flat connection Feature D1	Frame clamp Feature D2	Flat connection	Frame clamp
7	NH00/M8/12-15 Nm Cable lug ≤ 25mm	-	NH2/M12/35-40 Nm Cable lug ≤ 43mm	-
8	NH2/M12/35-40 Nm Cable lug ≤ 43mm	NH2/32 Nm	NH2/M12/35-40 Nm Cable lug ≤ 43mm	NH2/32 Nm
10	NH2/M12/35-40 Nm Cable lug ≤ 43mm	NH2/32 Nm	NH2/M12/35-40 Nm Cable lug ≤ 43mm	NH2/32 Nm
11	NH00/M8/12-15 Nm Cable lug ≤ 25mm	-	NH2/M12/35-40 Nm Cable lug ≤ 43mm	-

Table 5-12 Torques and connection technology depending on rated current up to 355 A

No.	Explanation			
	400 A <I_N ≤580 A		910 A=<I_N	
	Flat connection Feature D1	Frame clamp Feature D2	Flat connection	
7	NH3/M12/35-40 Nm Cable lug ≤ 43mm	-	NH3+/M12/35-40 Nm Cable lug ≤ 43mm	
8	NH3/M12/35-40 Nm Cable lug ≤ 43mm	NH3/32 Nm	NH3+/M12/35-40 Nm Cable lug ≤ 43mm	
10	NH3/M12/35-40 Nm Cable lug ≤ 43mm	NH3/32 Nm	NH3+/M12/35-40 Nm Cable lug ≤ 43mm	
11	NH3/M12/35-40 Nm Cable lug ≤ 43mm	-	NH3+/M12/35-40 Nm Cable lug ≤ 43mm	

Table 5-13 Torques and connection technology depending on rated current up to 910 A

5.3.10.2 Systems with terminals

The operation of the terminals is described in chapter 5.3.10.3.

- Connect the local grounding point to the *PE(N)-rail.*
- Connect PE(N) input (transformer grid connection) to *PE(N)-rail.*
- Connect PE(N) output (grid connection load) to *PE(N)-rail.*
- Connect transformer block to *PE(N)-rail.*
- Connect the connecting cables of the transformer block to the terminal points.
- Connect the connecting cables of the low-voltage grid to the terminal points.

TN-C system

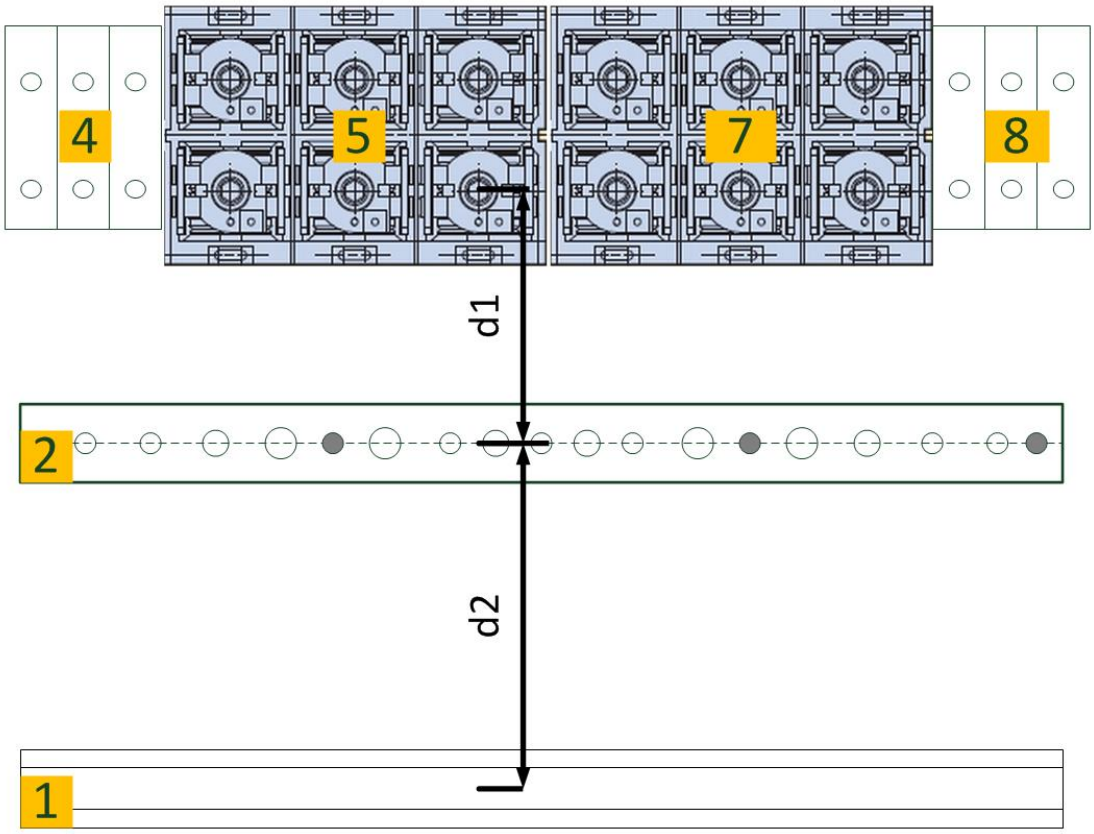


Figure 5-21 Overview of terminal points for TN-C systems and connection terminals

TN-S/TT ystem

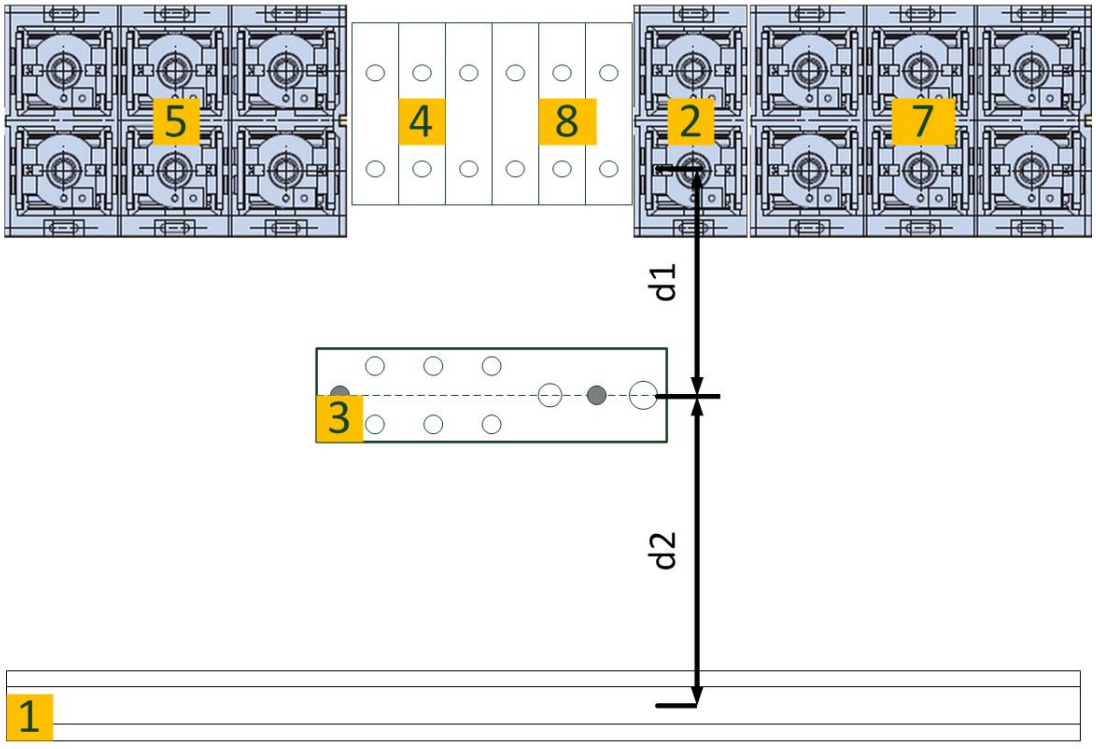


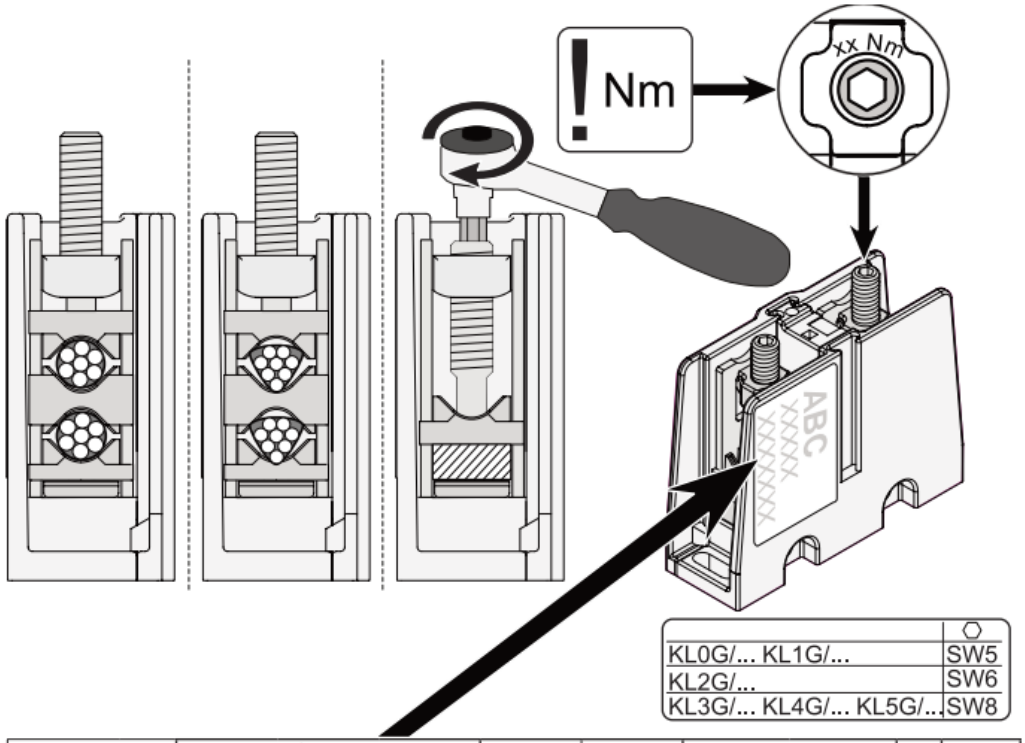
Figure 5-22 Overview of terminal points for TN-S/TT systems and terminals

No.	Explanation
1	C-profile rail 30x15 for fixing the cables
2	TN-C PEN-rail 30 mm x 5 mm x 400 mm – 500 mm Free rivet nuts M8/M10/M12 TT/TN-S N conductor terminal block
3	PE rail 40 mm x 5 mm x 150 mm Free rivet nuts M8/M10/M12
4 (F1)	3x connecting cable (thick cables) of the transformer block (L1IN / L2IN / L3IN)
5 (F2)	Customer connection input side (direction local grid transformer)
7 (F4)	Customer connection output side (direction load)
8 (F5)	3x connecting cable (thick cables) of the transformer block (L1OUT / L2OUT / L3OUT)
d1	Centre distance PEN rail to connection points fuse-switch-disconnector block 180 mm
d2	Centre distance PEN rail to C-profile rail (cable catch) Aluminum housing: 215 mm GFK housing: 145 mm

Table 5-14 Explanation of the graphics

5.3.10.3 Operation of terminals

- Insulate the conductor according to Figure 5-23.
- Insert conductors of the same cross-section as shown in Figure 5-24.
- Insert conductors in sector version according to Figure 5-24.
- Assemble terminal according to Figure 5-24.
- Tighten terminal to torque as shown in Figure 5-23.
- Install the cover as shown in Figure 5-25.



		Cu/Al [mm²]			Cu [mm²]	Al [mm²]	[mm]			[mm]
									Nm	
KL0G/...	1	10-50	16-95	50-95	35-95	35-70	max. 16	max. 10	20	30
KL1G/...	1	16-50	16-150	50-150	35-150	50-120	max. 16	max. 10	20	30
	2		16-70	50-70	35-70	35-50				
KL2HG/...	1	25-50	25-240	50-185	35-240	95-185	max. 25	max. 15	40	30
	2		25-120	50-120	35-120	50-95				
KL3G	1	—	150-300	150-185	150-240	150-240	max. 40	max. 20	50	45
	2	35-70	35-185	95-185	95-185	95-185				
KL4G	1	50	50-300	70-185	70-300	—	max. 50	max. 20	50	45
	2		50-240		70-185	150-185				
	3		50-185			95-150				
KL5G-3	1	50	50-300	95-185	95-240	—	max. 60	max. 20	60	45
	2					150-240				
	3		50-240			150-185				
KL5G-4	2	50	50-300	95-185	95-240	240	max. 60	max. 20	60	45
	4				95-185	120-150				

Figure 5-23 Photo instruction use of terminal block 1

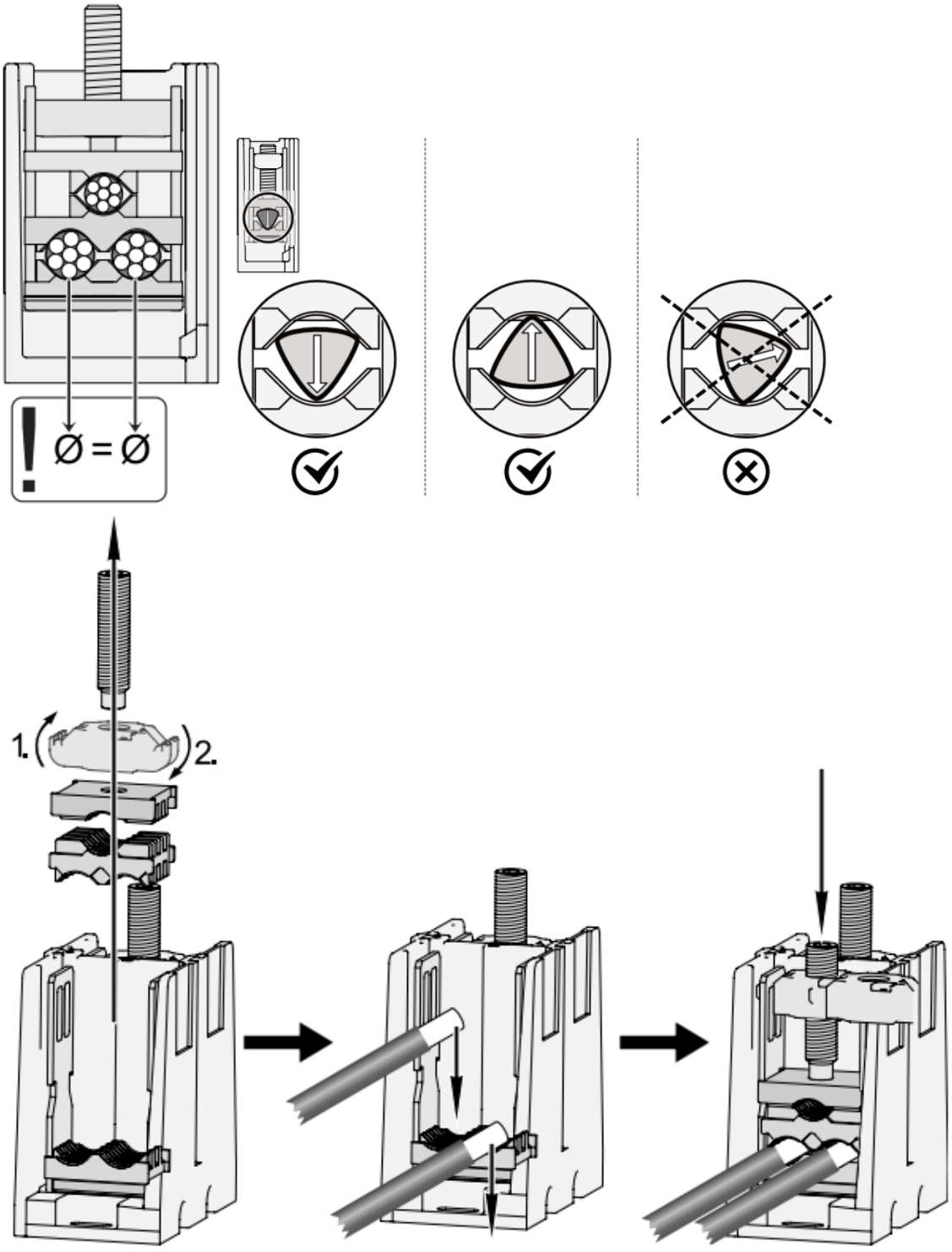


Figure 5-24 Photo instruction use of terminal block 2

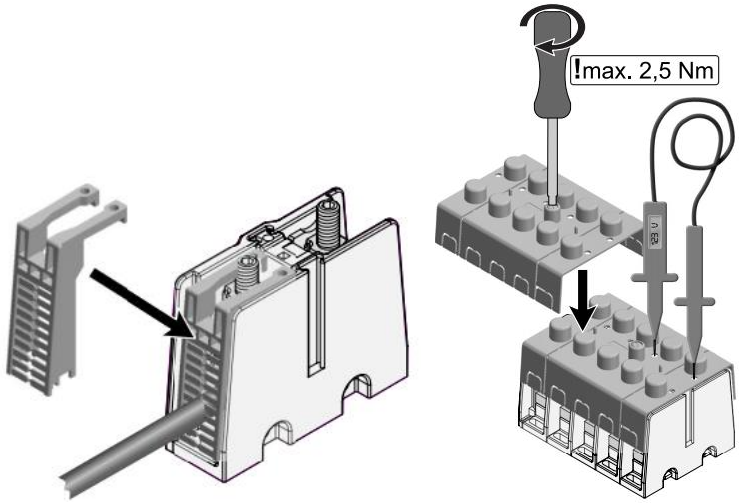


Figure 5-25 Photo instruction use of terminal block 3

5.3.10.4 Current transformers for NH00 switch-disconnectors (single phase transformers)

Systems with rated currents ≤ 160 A are equipped with NH00 switch-disconnector-fuses for the LVRSysIN and LVRysOUT connections (standard). The optional current transformer must then also be looped into the LVRSysOUT transformer cables.

- Disconnect the transformer from the mounting rail.
- Feed the transformer cable (LVRSysOUT) through the transformer.
- Connect the transformer cable (LVRSysOUT) to the NH00 Safety Edge.
- Fix transformer (with screw from above) and transformer cable (with cable tie) to transformer cable (LVRSysOUT).

Figure 5-26 *Cable routing of the transformer cables LVRSysOUT through the walls and fixing to the cable.*

5.3.10.5 Current transformers for NH00 switch-disconnectors (three phase transformers)

Systems with rated currents ≤ 160 A are supplied with NH00 switch disconnectors (LVRSysIN & LVRSysOUT). The optional current transformer must then be grinded at the transformer block connection cables LVRSys OUT.

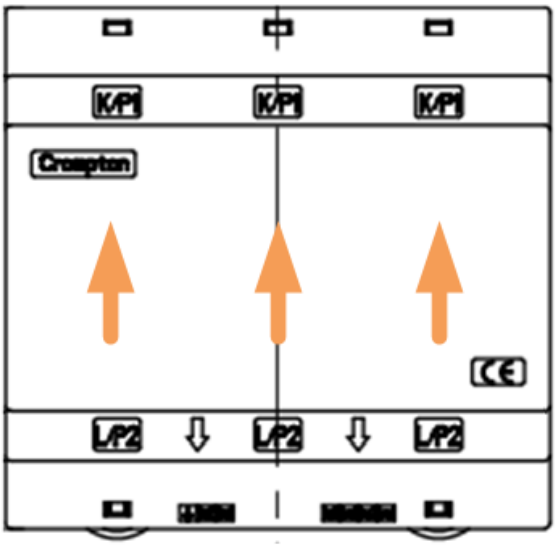


Figure 5-27 direction of transformer block connection cables LVRSys OUT through the current transformer

5.3.10.6 Current transformers for NH2/NH3 safety edges

Current transformers are integrated in the LVRSysIN (-F1 input current measurement) or LVRSysOUT (-F5 output current measurement) safety edges.

5.4 Systems for indoor installation

5.4.1 Requirements for indoor installation

- Ensure that heat is dissipated by sufficient air circulation.
- Observe the following minimum distances:
  - 50 cm to the ceiling
  - 100 cm to 120 cm in the door area.

5.4.2 Base mounting

Systems for indoor installation are supplied with a pre-assembled base.

5.4.3 Transformers

Systems for indoor installation are supplied with pre-assembled transformers.

5.4.4 Mounting the base LVRSys™ indoor installation on the floor

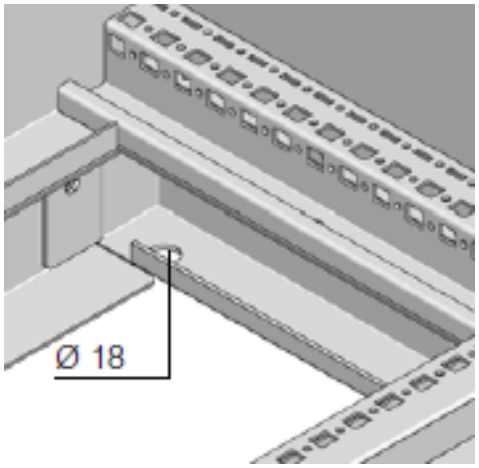


Figure 5-28 *Fixing passages for socket*

- Prepare holes and dowels for fixing the base to the floor.
- Connect the base to the floor using four fixing holes.
- Fix the base with screws M 12.

5.4.5 Connecting the low-voltage cables

The connection terminals are only approved for copper lines. Aluminum conductors may only be connected in the sector conductor version.

TN-C system & connection terminals

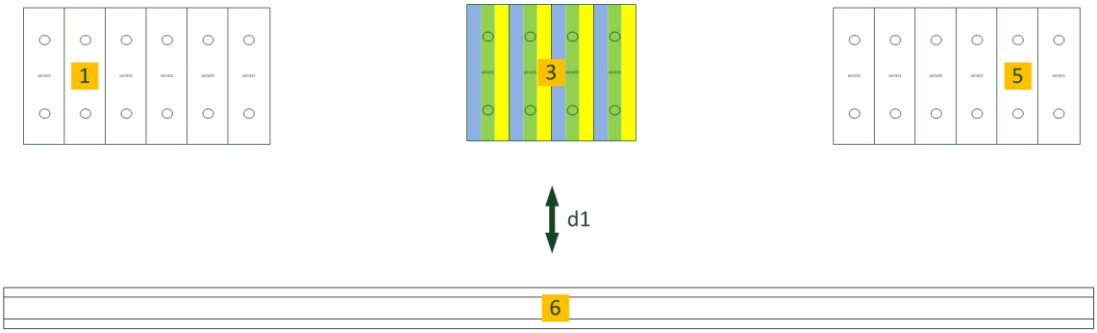


Figure 5-29 *Overview of the terminal points for TN-C systems and connection terminals*

TN-C system & flat connection

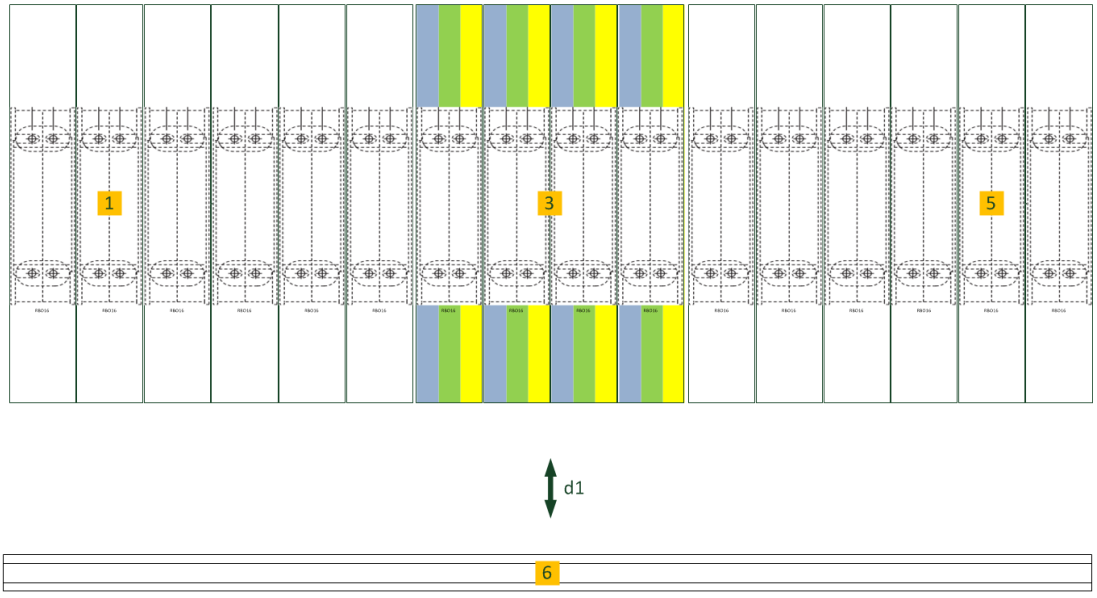


Figure 5-30 *Overview of the terminal points for TN-C systems and flat connection*

TN-S/TT system & connection terminals

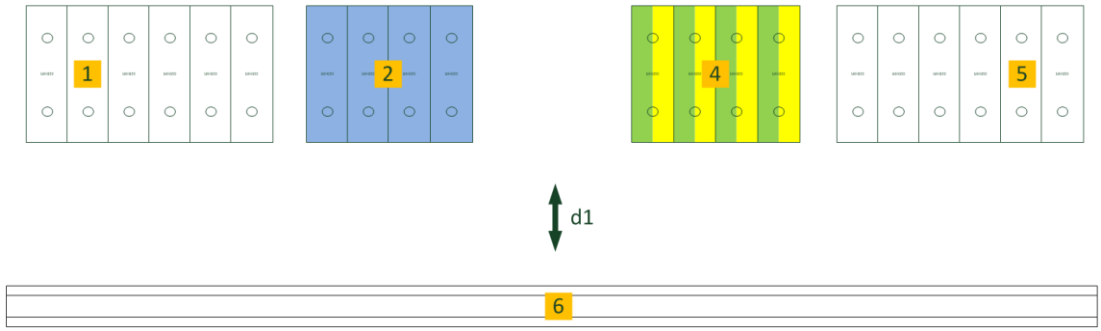


Figure 5-31 *Overview of terminal points for TN-S/TT systems and connection terminals*

TN-S/TT system & flat connection

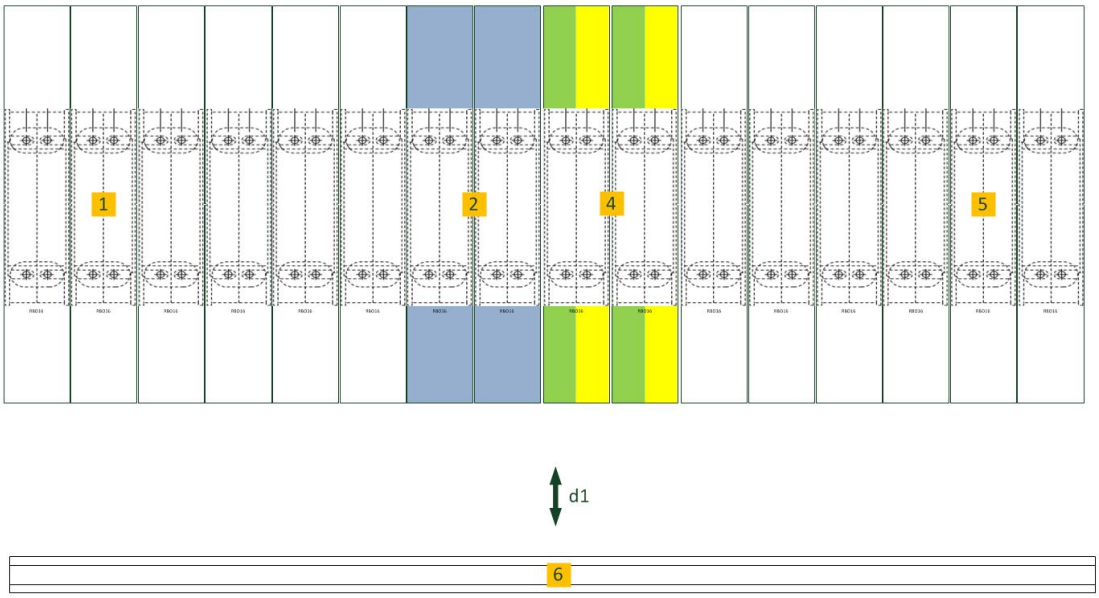


Figure 5-32 *Overview of the terminal points for TN-S/TT systems and flat connection*

No.	Explanation
1	Connection for customer input cable L1IN/L2IN/L3IN
2	Connection for customer cable N (TN-S/TT-System)
3	Connection for customer cable PEN (TN-C-System)
4	Connection for customer cable PE (TN-S/TT-System)
5	Connection for customer output cable L1OUT/L2 OUT /L3 OUT
6	C-profile rail 30x15 for fixing the cables
d1	Centre distance C-profile rail to connection points 300mm

Table 5-15 Designation of the figures: Figure 5-29, Figure 5-30, Figure 5-31, Figure 5-32

No.	Frame clamp	Flat connection
1-5	UKH 70 Feature D31 16 - 70 mm² (Cu); 50/70 mm² (Al-se)	RBO 10 Feature D51 M10 (6 - 150 mm²)
	UKH 95 Feature D32 25 - 95 mm² (Cu); 70/95 mm² (Al-se)	RBO 12 Feature D52 M12 (25 - 240 mm²)
	UKH 150 Feature D33 35 - 150 mm² (Cu); 120 / 150 mm² (Al-se)	RBO 16 Feature D53 M16 (50 - 300 mm²)
	UKH 240 Feature D34 70 - 240 mm² (Cu); 185 / 240 mm² (Al-se)	

Table 5-16 Design of the terminal points

Terminal/ Flat connection	Connection
UKH 70 I_N 192 A	Rigid: 16mm² - 95mm² Flexible: 25mm² - 70mm² Flexible with wire end ferrule without plastic ferrule: 16mm² - 70mm² Stripping length: 24 mm Screw thread M8 Tightening torque: 8 Nm – 10 Nm
UKH 95 I_N 232 A	Rigid: 25mm² - 95mm² Flexible: 35mm² - 70mm² Flexible with wire end ferrule without plastic ferrule: 35mm² - 95mm² Stripping length: 33 mm Screw thread M8 Tightening torque: 15 Nm – 20 Nm
UKH 150 I_N 309 A	Rigid: 35mm² - 150mm² Flexible: 50mm² - 150mm² Flexible with wire end ferrule without plastic ferrule: 50mm² - 150mm² Stripping length: 40 mm Screw thread M10 Tightening torque: 25 Nm – 30 Nm
UKH 240 I_N 415 A	Rigid: 70mm² - 240mm² Flexible: 70mm² - 240mm² Flexible with wire end ferrule without plastic ferrule: 70mm² - 185mm² Stripping length: 40 mm Screw thread M10 Tightening torque: 25 Nm – 30 Nm
RBO 10 I_N 309 A	Screw thread: M10 Cable lug connection: 6mm² - 150mm² Maximum cable lug width: 30 mm Tightening torque: 10 Nm – 20 Nm
RBO 12 I_N 415 A	Screw thread: M12 Cable lug connection: 25mm² - 240mm² Maximum cable lug width: 38 mm Tightening torque: 14 Nm – 30 Nm
RBO 16 I_N 520 A	Screw thread: M16 Cable lug connection: 50mm² - 300mm² Maximum cable lug width: 48 mm Tightening torque: 25 Nm – 30 Nm

Table 5-17 Connection data of terminal points

5.5 Pole mount Systems

5.5.1 Mounting the LVRSys™ on the pole

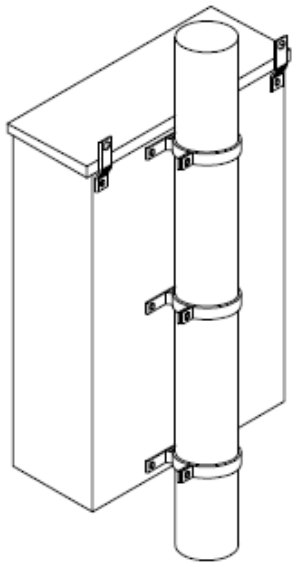
⚠ DANGER!	**Danger to life du to twisting of pole!** Make sure that the pole carries the weight of 50 kg (1- phase) - 150 kg (3- phase). Ensure that the pole with the system is designed according to wind load.

⚠ DANGER!	**Danger to life falling down of the control cabinet!** Make sure lifting lugs are completely screwed in. Make sure that fastening nuts are secured against unscrewing.

5.5.1.1 Mounting on a round pole

Special mounting clamps are available for round poles, which are individually manufactured according to the diameter of the pole.

- ➲ Connect the flat bar of the mounting clamp to the switch cabinet (M10 & 45 Nm).
- ➲ Lifting and aligning the system with a crane
- ➲ Connect round bracket with counterpart (M 12 & 75 Nm)



Positioning the pole clamps (3- phase)

Upper clamp at height: 1165mm
Middle clamp at height: 600mm
Lower clamp at height: 35mm

Positioning the pole clamps (1- phase)

Upper clamp at height: 965mm
Middle clamp at height: 500mm
Lower clamp at height: 35mm

Figure 5-33 Overview drawing of pole mounting systems attachment

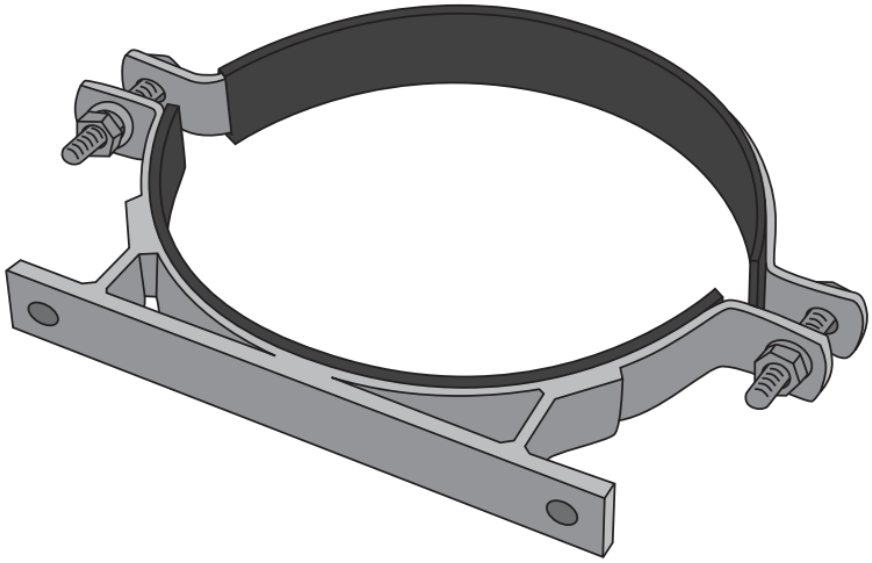


Figure 5-34 *Mounting clamp for round poles*

Figure 5-35 *Mounting clamp on switch cabinet*

5.5.1.2 Mounting on an rectangled pole

The mounting system will be delivered with:

- 3 mounting rails on the back of the cabinet
- 3 mounting rails for fixation 700 mm (long)
- 7 threaded rods 700 mm long M12
- 7 movable pipe ring saddels
- Fixing nuts and washers

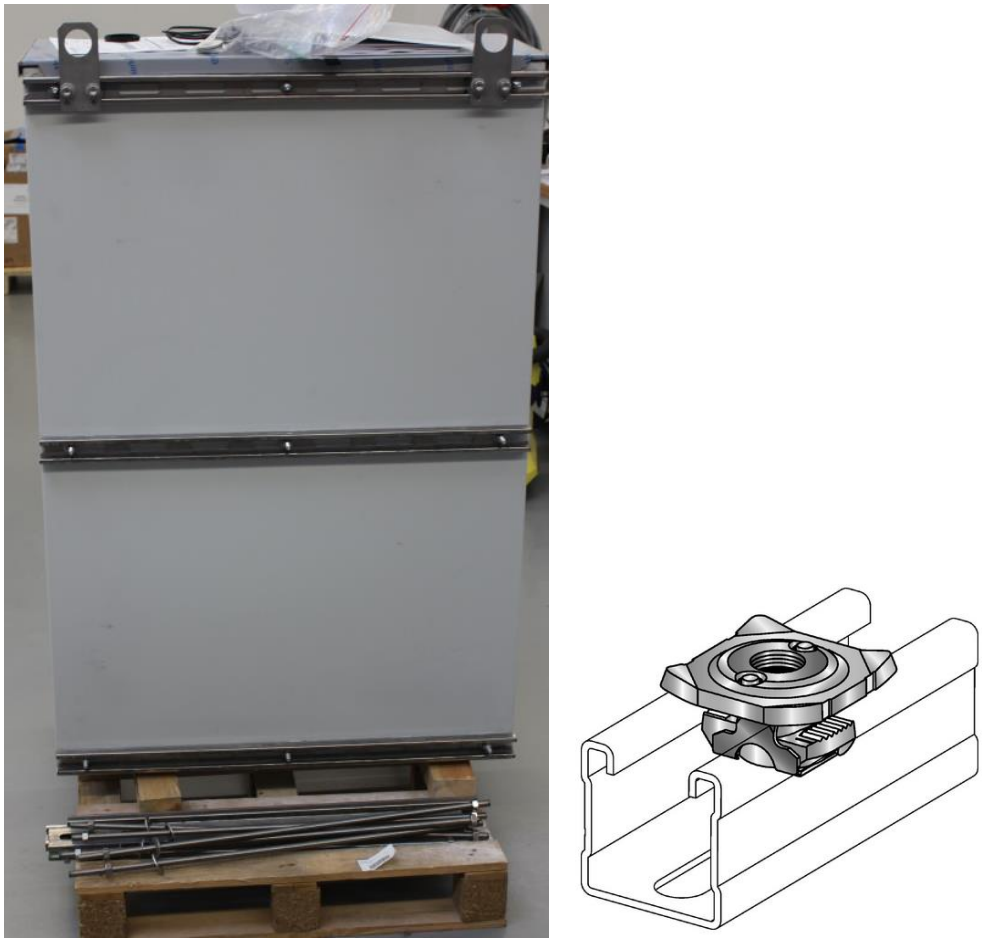


Figure 5-36 Cabinet with installation channels (left) movable pipe ring saddels (right)

Installation:

- Threaded rods have to be fixed in ring saddles with nuts, perhaps shorten threaded rods suitable for pole. (See Figure 5-37 Installation thread rods in ring saddle)
  Needed tool: Spanner with SW 19mm – T_{inst} = 31 Nm (24 ft-lb)
- On upper installation channel have to be 3 thread rods. The middles thread rod has to be installed through the pole, therefore is a hole in the middle of the pole necessary (min. 30 mm diameter).
- Lift cabinet to the pole.
- Fixation of the cabinet through installation channels with washers and nuts. (see Figure 5-38 Top view pole installation)

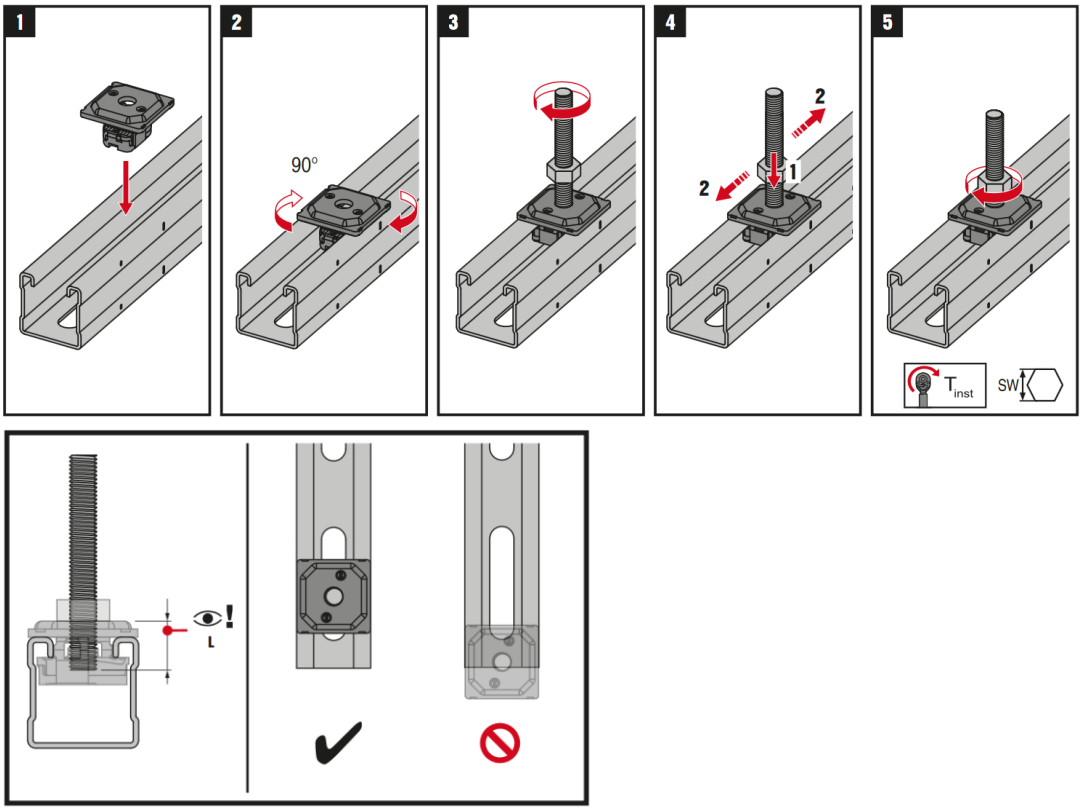


Figure 5-37 Installation thread rods in ring saddle

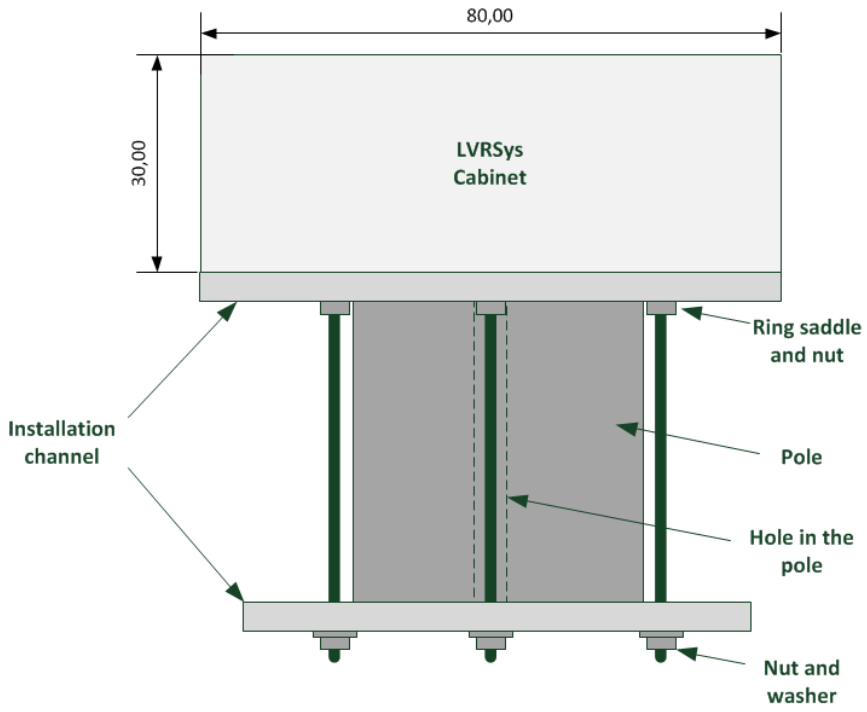


Figure 5-38 Top view pole installation

5.5.2 Connecting the low-voltage cables on the grid side

The connection of 3-phase systems is outlined below. 1-phase systems are connected analogously with a reduced number of terminals.

- ➲ Insulating the connecting cable
- ➲ Guide the connection cable through the PG cable glands.
- ➲ Attach connection cable to clamping point

TN-C system & connection terminals

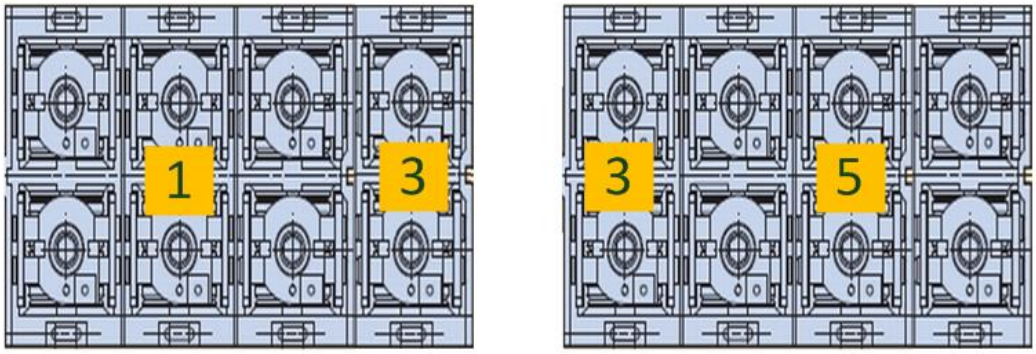


Figure 5-39 Overview of terminal points for TN-C systems and connection terminals

TN-S/TT system & connection terminals

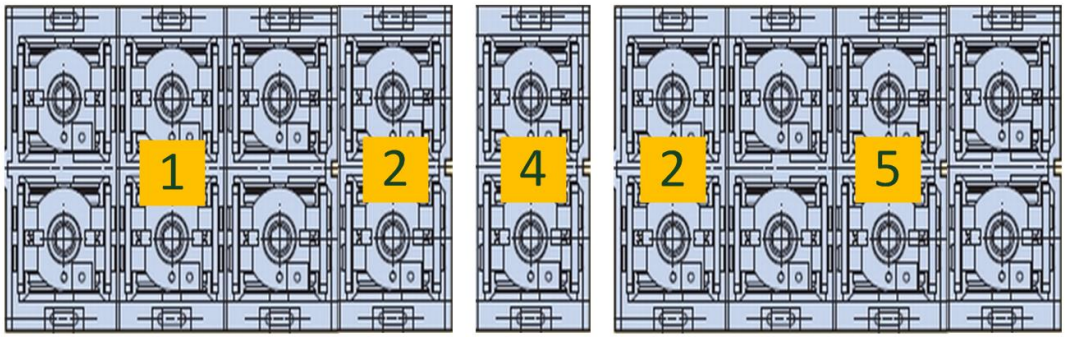


Figure 5-40 Overview of terminal points for TN-S/TT systems and terminals

No.	Explanation
1	Connection for customer input cable L1IN/L2IN/L3IN
2	Connection for customer cable N (TN-S/TT-System)
3	Connection for customer cable PEN (TN-C-System)
4	Connection for customer cable PE (TN-S/TT-System)
5	Connection for customer output cable L1OUT/L2 OUT /L3 OUT

Table 5-18 Explanation of the connection terminals

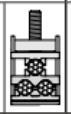
		Cu/Al [mm²]			Cu [mm²]	Al [mm²]	[mm]			[mm]
									Nm	
KL0G/...	1	10-50	16-95	50-95	35-95	35-70	max. 16	max. 10	20	30

Figure 5-41 Design of the connection terminals

Required tool: Internal hex SW 5.

5.6 External installations

You must select characteristic P1 during the ordering process. The installation space is also required. This may change the size of the housing. By default, an installation space of W/D /H 400 mm / 100 mm / 300 mm is available.

6. Commissioning & Decomissioning LVRSys™

6.1 Lights & Switches

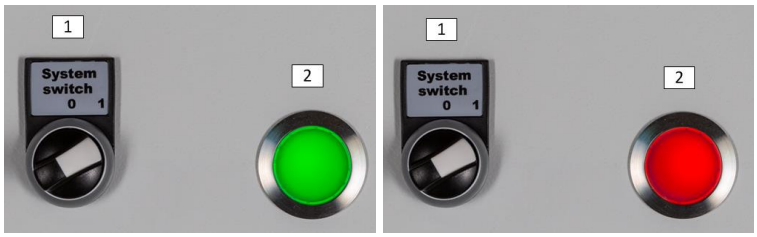


Figure 6-1 Lights and switches

1	System switch (0: position off; 1: position on)
2	Signal lamp (green: operation; red: error)

Table 6-1 Explanation of numbering

6.2 Commissioning and decomissioning LVRSys™

For operating the LVRSys IN, LVRSys OUT and BYPASS, observe chapter 6.5.

The starting position is:

- Closed BYPASS (F3).
- Opened input (F1 / LVRSys IN).
- Opened output (F5 / LVRSys OUT).
- The controller is in the Off state.

⚠ **DANGER!**	**Risk of fatal injury from electric shock!**
	Ensure that the LVRSysTM is only operated and put into operation by qualified electricians or persons trained in electrical engineering who are either certified in accordance with VDE 0105-100 or certified with respect to the local wiring and safety regulations applicable in your country.
	Never partially open LV fuse switch disconnectors.
	Only ever actuate LV fuse switch disconnectors by using the handle.

⚠ **CAUTION!**	**Destruction of components due to overload!**
	Only Switch the LVRSys™ On and Off as described above.
	Never activate BYPASS during CONTROL operation.

Commissioning LVRSys™

Sequence:

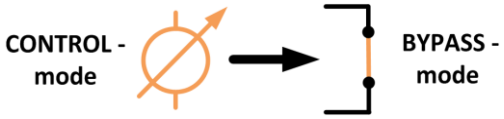
1. Close *LVRSys IN-F1*
(with knives/fuses).

2. Close *LVRSys OUT-F5*
(with knives/fuses).

3. Open *BYPASS-F3*
(remove knives).

4. Set the system switch to *ON* position.
- The controller starts up automatically.
- LVRSys™ is active.
- The local network is regulated by the LVRSys™.

Decommissioning LVRSys™ BYPASS



Sequence:

1. Set the system switch to *OFF* position.
- Wait until secondary electronics is de-energised.
(Display goes out after approx. 10 s).

2. Close *BYPASS-F3* (with knives).

3. Open LVRSys OUT-F5 (remove knives/fuses).

4. Open LVRSys IN-F1 (remove knives/fuses).
- The LVRSys™ is completely disconnected from the network.
- The *BYPASS* is active.

The network is supplied via the BYPASS.
- Check that there is no voltage (Kap. 0).

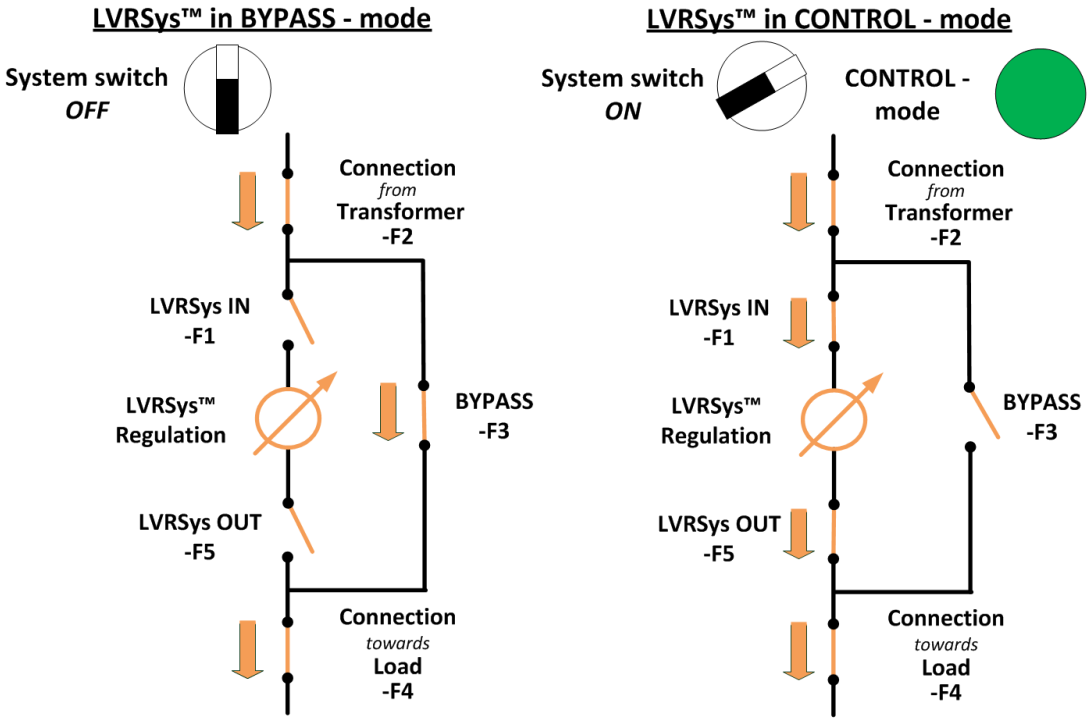


Figure 6-2 Circuit principle bypass and operation

6.3 Check that there is no voltage

⚠ DANGER!	**Danger of electric shock!**
	Check that there is no voltage on the system input
	Check that there is no voltage on the system output
	Only measure with fused measuring devices with rated overvoltage category IV

- Check that there is no voltage at the input (LVRSys IN).
- Check that there is no voltage at the output (LVRSys OUT).

Systems with circuit breakers: Check that there is NO VOLTAGE meaured on L1/L2/L3 (directly at the circuit breaker) with respect to PEN/PE busbar.

Systems with LV switch disconnectors: Check that there is NO VOLTAGE meaured on L1/L2/L3 (directly on the outgoing switch disconnector) with respect to PEN/PE busbar.

Systems with LV fuse switch disconectors: Check that there is NO VOLTAGE meaured on L1/L2/L3 (directly on the outgoing fuse switch disconnector) with respsect to PEN/PE busbar.

6.4 Current transformer N/PEN-rail

⚠ DANGER!	**Danger of electric shock!**
	Short circuit the disconnect terminal blocks

In bypass operation, the 3 phases are bypassed. The neutral conductor or the PEN conductor continue to supply current in bypass mode. If a current transformer is installed to measure the N / PEN conductor current, it continues to measure current in bypass mode and must not be interrupted on the secondary side. The transformer must be short-circuited via the isolating and measuring terminal (short-circuit mode/lever down).

Figure 6-3 Left: Current transformer in operation mode; Right: current transformer in short circuit mode

6.5 Operation of circuit breakers and switch disconnectors

6.5.1 Operation of systems with circuit breakers

When switching the devices, the following must be observed:

- Ensure that commissioning, decommissioning and operation are only carried out by qualified electricians or persons trained in electrical engineering in accordance with VDE 0105-100 or certified with respect to the local wiring and safety regulations applicable in your country.
- Only operate the circuit breaker using the operating handle.
- Fast operation of circuit breakers.

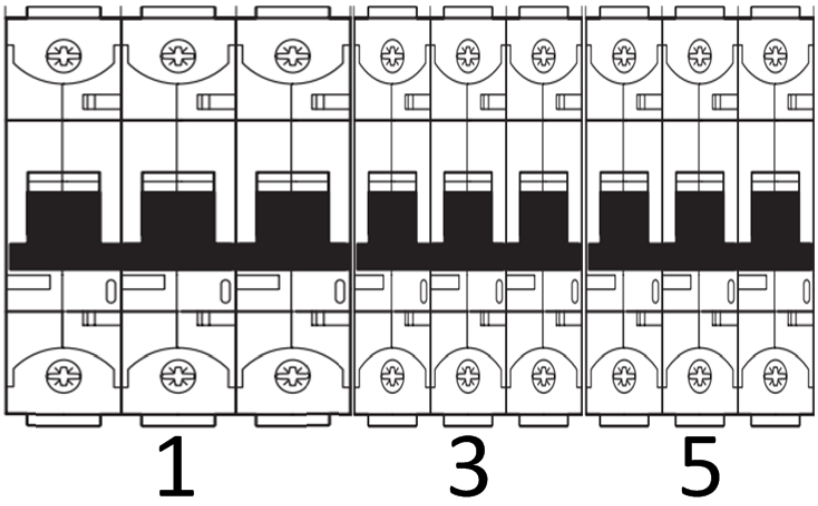


Figure 6-4 Connection and BYPASS function

1	Circuit breaker for **LVRSysIN – F1**
2	Terminal block for external input cables (mains connection transformer)
3	Circuit breaker for **BYPASS – F3**
4	Terminal block for external output cables (mains connection load)
5	Circuit breaker for **LVRSysOUT – F5**

Table 6-2 Explanation of numbering

Figure 6-5 Circuit breaker state OFF

6.5.2 Operation of systems with switch disconnectors

⚠ **DANGER!**	**Risk of fatal injury from electric shock!** Never partially open the LV switch disconnector. Actuate the LV switch disconnector using the handle.

Its intended that LV fuses are to be used only by qualified electricians or persons trained in electrical engingeering,eg IEC 60269-2 or certified with respect to the local wiring and safety regulations applicable in your country.

When switching the devices, the following must be observed:

- Ensure that commissioning, decommissioning and operation are only carried out by qualified electricians or persons trained in electrical engineering in accordance with VDE 0105-100 or certified with respect to the local wiring and safety regulations applicable in your country.
- Ensure that only fuse links with silver-plated knives or silver-plated disconnection knives are used.
- The switch disconnector must only be operated using the handle.
- Actuate the switch disconnector quickly.

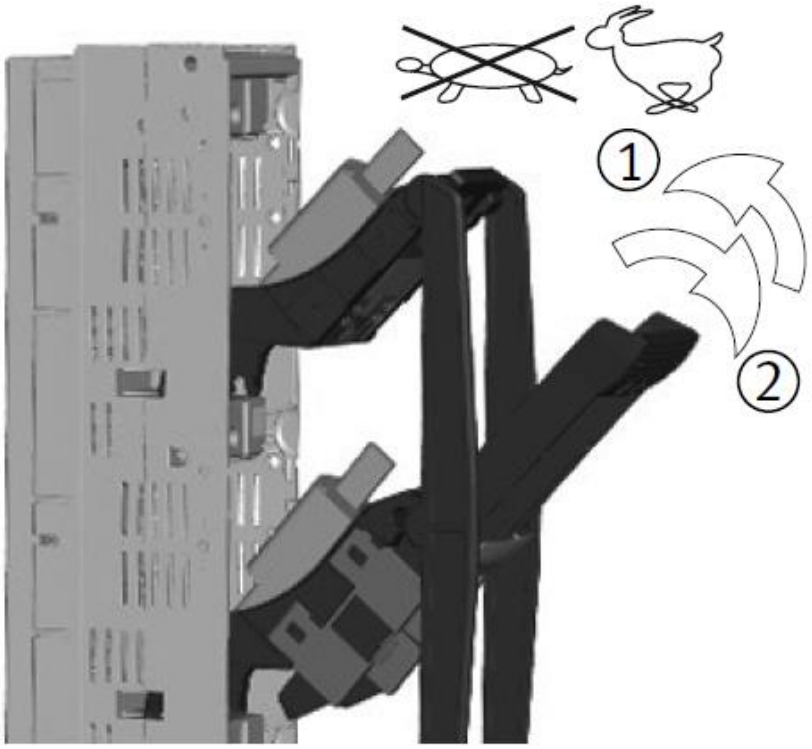


Figure 6-6 Operation switch disconnector

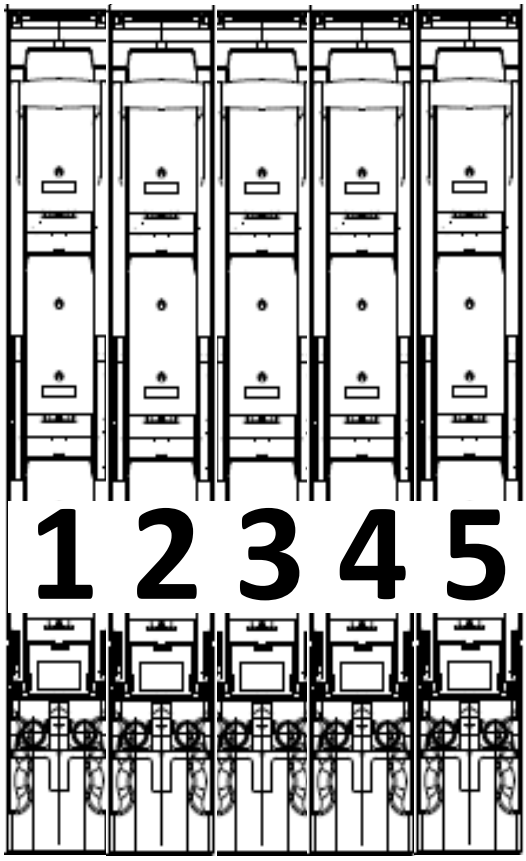


Figure 6-7 NH switch disconnectors

⚠ CAUTION!	**Voltage interruption in the low voltage network!** (2) Contact strip LV mains input, never switch! (4) Contact strip LV mains output, never switch!

1	Connection switch disconnector for **LVRSysIN – F1** (internal/transformer block secondary line input)
2	Connection of switch disconnector for external input cables (mains connection transformer – F2)
3	Coupling strip **BYPASS – F3**
4	Connection of switch disconnector for external output cables (mains connection load – F4)
5	Connection switch disconnector for **LVRSysOUT – F5** (internal/transformer block secondary line output)

Table 6-3 Explanation of numbering

6.5.3 Operation of systems with LV fuse-switch-disconnectors

⚠ DANGER!	**Risk of fatal injury from electric shock!**
	Never partially open LV fuse switch disconnectors
	Operate the LV fuse switch disconnectors on the handle.

Its intended that LV fuses are only used by qualified electricians or persons trained in electrical engineering eg: IEC 60269-2 or certified with respect to the local wiring and safety regulations applicable in your country.
When switching the devices, the following must be observed:

- Ensure that commissioning, decommissioning and operation are only carried out by qualified electricians or persons trained in electrical engineering in accordance with VDE 0105-100. or certified with respect to the local wiring and safety regulations applicable in your country.
- Ensure that only fuse links with silver-plated knives or silver-plated disconnection knives are used.
- Only operate LV fuse switch disconnectors by the operating handle.
- Always operate LV fuse switch disconnectors quickly.

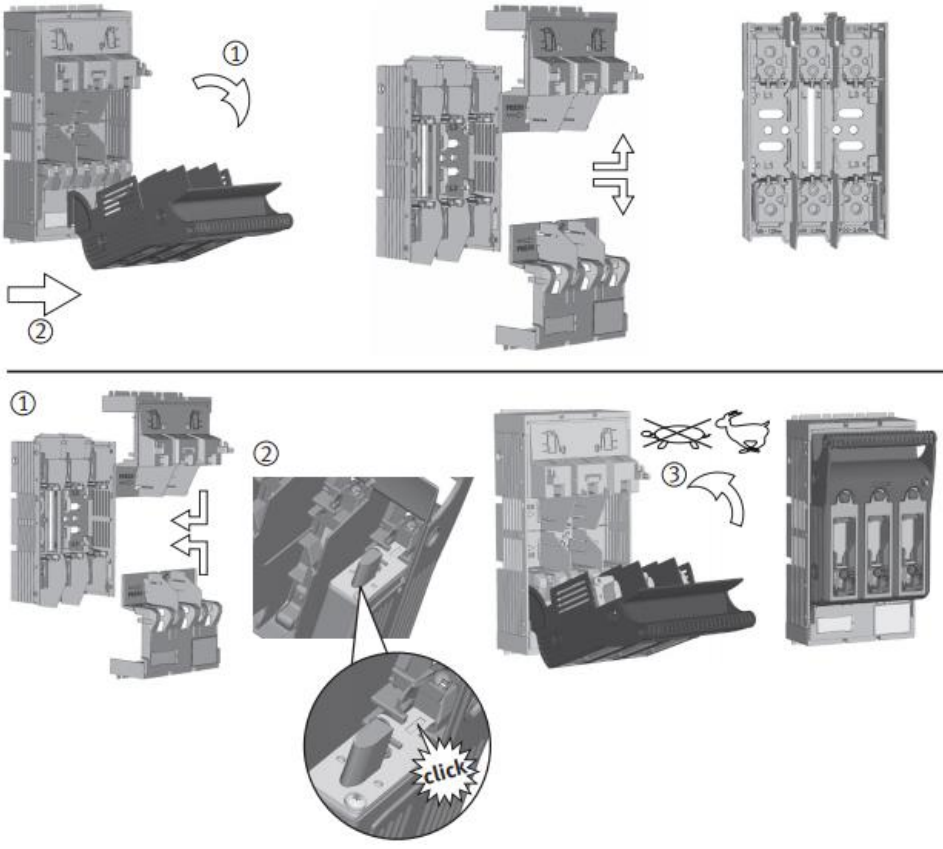


Figure 6-8 Operation fuse switch disconnector

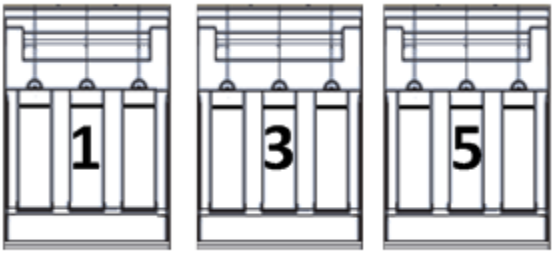


Abbildung 6-9 LV fuse switch disconnector

⚠ **CAUTION!**	**Voltage interruption on the low voltage network!** (1/5) Operate fuse switch disconnector according to instructions! (3) Operate BYPASS fuse switch disconnector according to instructions! See chapter 6.2 Commissioning and decomissioning LVRSys™

1	Connection fuse switch disconnector for **LVRSysIN – F1** (internal/transformer block secondary line input)
3	Fuse switch disconnector **BYPASS – F3**
5	Connection fuse switch disconnector for **LVRSysOUT – F5** (internal/transformer block secondary line output)

Table 6-4 Explanation of numbering

Notes

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